ORIGINAL

N4425521RP00015

RIGHT OF ENTRY AGREEMENT

In consideration of the assistance and benefits as described herein, (b) (6) [redacted] Trustee (herein after referred to as the "OWNER"), located at (b) (6) [redacted] WA 98239, hereby grants to the UNITED STATES OF AMERICA, DEPARTMENT OF THE NAVY, its employees, agents, contractors and subcontractors (collectively known as the "GOVERNMENT"), a right of entry upon the premises described below, located in the State of Washington, with the following terms and conditions, effective beginning on November 13, 2020 and ending on December 31, 2021, unless sooner terminated under the terms and conditions herein set forth.

Premises: Island County Parcel (b) (6) [redacted] and as depicted in the attached Exhibit "A".

Purpose: The OWNER grants to the GOVERNMENT a right to enter the premises to place a sound level meter on the property for four (4) non-contiguous weeks during the term of this Right of Entry Permit. The equipment is temporary in nature and consists of a standard tripod with a microphone attached at approximately 5 feet high and connected to a small battery pack with a solar panel.

Notification: Government will provide at a minimum 24-hour's notice prior to access by contacting the Point of Contact identified below.

Ownership of Tools and Equipment: All tools, equipment, and other property taken upon or placed upon the Premises by the GOVERNMENT shall remain the property of the GOVERNMENT and will be removed by the GOVERNMENT at the end of each of the four (4) non-contiguous weeks of this right of entry.

No Warranty: OWNER grants this right of entry without warranty, either express or implied, regarding to the suitability of the condition of the Premises. The GOVERNMENT shall not hold OWNER liable for any shortage or defect in any part of the Premises or on account of theft of, or damage to, the GOVERNMENT's tools, equipment or other property taken or placed upon the Premises or any physical injury, death or disability of GOVERNMENT employees, trainees, or other personnel associated with the purpose of this Agreement, except where such loss, damage, injury, death, or disability is caused by the fault or negligence of the OWNER.

Liability Limits: The GOVERNMENT agrees to be responsible for damages arising from the activity of the Navy, its officers, employees, authorized representatives (including contractors) on the OWNER's land, under this right of entry, to the extent

authorized by law, including the Federal Tort Claims Act (28 U.S.C. § 2671 et seq.).

The OWNER shall not be responsible for damages to the property or injuries to persons which may arise from or be incident to the GOVERNMENT's use and occupation of such premises pursuant to this right of entry, nor for the damages to the property of or injuries to the GOVERNMENT, or others who may be on the premises at the GOVERNMENT's invitation, except where such damages or injuries are due to the fault or negligence of the OWNER.

The GOVERNMENT shall not be responsible for damages to property or injuries to persons which may arise from or be incident to the use and occupation of the premises by the OWNER, its agents, servants, or employees, or others who may be on the premises at the OWNER's invitation, except where such damages or injuries are due to the fault or negligence of the GOVERNMENT.

Termination: OWNER may terminate this right of entry in the event the GOVERNMENT fails to comply with the terms and conditions of this agreement or in the event of a change of ownership or use of the Premises that OWNER deems inconsistent with continued GOVERNMENT use of the premises. Prior to terminating this right of entry, OWNER shall give the GOVERNMENT no less than thirty (30) days' notice. GOVERNMENT shall have (30) days from receipt of said notice to remedy any failure to comply with the terms and conditions of this right of entry.

Compliance with Laws: All activities performed by the GOVERNMENT on the Premises will be performed in a lawful and prudent manner and in compliance with applicable laws, rules, and regulations, and will not unreasonably interfere with OWNER's normal activities.

No Assignment: The GOVERNMENT may not assign this right of entry or the rights and obligations set forth herein, in whole or in part.

Points of Contact:

OWNER: (b) (6) [redacted]

GOVERNMENT: [redacted]
Realty Specialist
NAVFAC NW
[redacted]@navy.mil
[redacted]

Consideration: OWNER acknowledges as good and valuable consideration the benefits to be derived from this Right of Entry.

Authority: The signatories below represent that they are authorized to execute this Agreement on behalf of the parties.

Entire Agreement: This instrument contains the entire agreement between the parties and supersedes any prior understanding, whether written or verbal.

In Witness hereof, the parties hereto have mutually agreed upon the terms and conditions of this instrument and caused it to be executed as below subscribed:

OWNER

B[redacted]
Trustee
Date: 11-12-2020

UNITED STATES OF AMERICA

B[redacted]
Real Estate Contracting Officer
Date: 11/16/2020

(b) (6)

[redacted]

Logistic Trip Summary: Naval Air Station Whidbey Island

This report provides a summary of a logistics trip to Naval Air Station Whidbey Island (NASWI) for the Navy's sound monitoring study. The objectives for this trip were to (1) review the primary and alternate sound monitoring sites around Ault Field and Naval Outlying Field (NOLF) Coupeville, (2) conduct interviews with pilots and Air Traffic Control (ATC), and (3) observe current flight operations. The purpose of visiting the primary and alternate sound monitoring sites was to evaluate each location for suitability, determine access requirements, and identify any sound level meter (SLM) security concerns. The pilot interviews were initially scheduled to be in-person, but due to coronavirus disease (COVID-19) restrictions, the interviews were conducted virtually via MS Teams with the BRRC and Leidos team. The team also conducted field observations of flight operations at Ault Field and NOLF Coupeville, and they assessed potential observation areas.

The team from Blue Ridge Research and Consulting, LLC (BRRC) traveled to NASWI during the week of 24 through 28 August 2020. A Leidos team member participated on 27 and 28 August. Personnel points of contact (POCs) for this site visit are identified below.

BRRC Team:	(b) (6) [redacted], Principal Investigator, and (b) (6) [redacted]
Leidos Team:	(b) (6) [redacted]
Primary NASWI POC:	(b) (6) [redacted], Community Planning and Liaison Officer (CPLO)
NAVFAC NW	(b) (6) [redacted], CPLO Northwest Training Range Complex
Office of the Assistant Secretary of the Navy (Environment)	(b) (6) [redacted]

Review of Primary and Alternate Sound Monitoring Sites

The sound monitoring approach involves the selection of ten to twelve SLM sites at NASWI. Primary and alternate SLM sites were selected utilizing a spatial stratification sampling technique to ensure a range of typical flight types and maneuvers are included in the monitoring data (see *Navy Aircraft Sound Monitoring Plan* for more details). The Navy also coordinated the identification of potential monitoring locations in consultation with local community leaders and applicable federal agencies. These consultations helped identify and determine monitoring locations that are of interest or concern to the community and that align with the objectives of the modeling assessment. Table 1 and Table 2 list the primary and alternate monitoring sites for Auld Field and NOLF Coupeville, respectively. These locations are also shown on Figure 1 and Figure 2.

Table 1. Primary and Alternate Monitoring Sites for Ault Field

Group	Site ID	Name
Primary	2B_T	Seaplane Base
	3A_T	Skagit River Dike
	4B_SG	Bowman Bay - Deception Pass State Park
	5B_SG	SE Lopez Island at Pt Colville – Bureau of Land Management (BLM) Land
	8B_SG	North Whidbey Parks & Recreation (on NASWI property)
Alternate	1A_T	Seaplane Base
	7A_T	Oak Harbor Christian Reformed Church (CRC)
	7B_T	Washington Golf & Country Club (WGCC)
	9B_SG	Corner of Banta Rd & Nortz Rd

Table 2. Primary and Alternate Monitoring Sites for NOLF Coupeville

Group	Site ID	Name
Primary	20B_SG	Perry House (Admirals Cove Alternative)
	24A_B	National Park Service (NPS) Reuble Farm
	25B_T	Residence
	26B_SG	Reeder Bay Limited Liability Company (LLC) parcel
	27A_SG	Town of Coupeville - Water Treatment Plant
	33_SG	Port Townsend Historic Downtown District - City Hall
Alternate	20A_B	Admiral Dr & Byrd Dr
	21B_T	Penn Cove Pottery
	21C_T	[redacted] Farm
	24B_B	NPS Ferry House
	24C_SG	Ebey's National Preserve - Bluff Trail
	25A_T	Residence
	29_SG	Rose Hip Farm-Crockett Lake Prairie
	32_T	Jackson St., Port Townsend

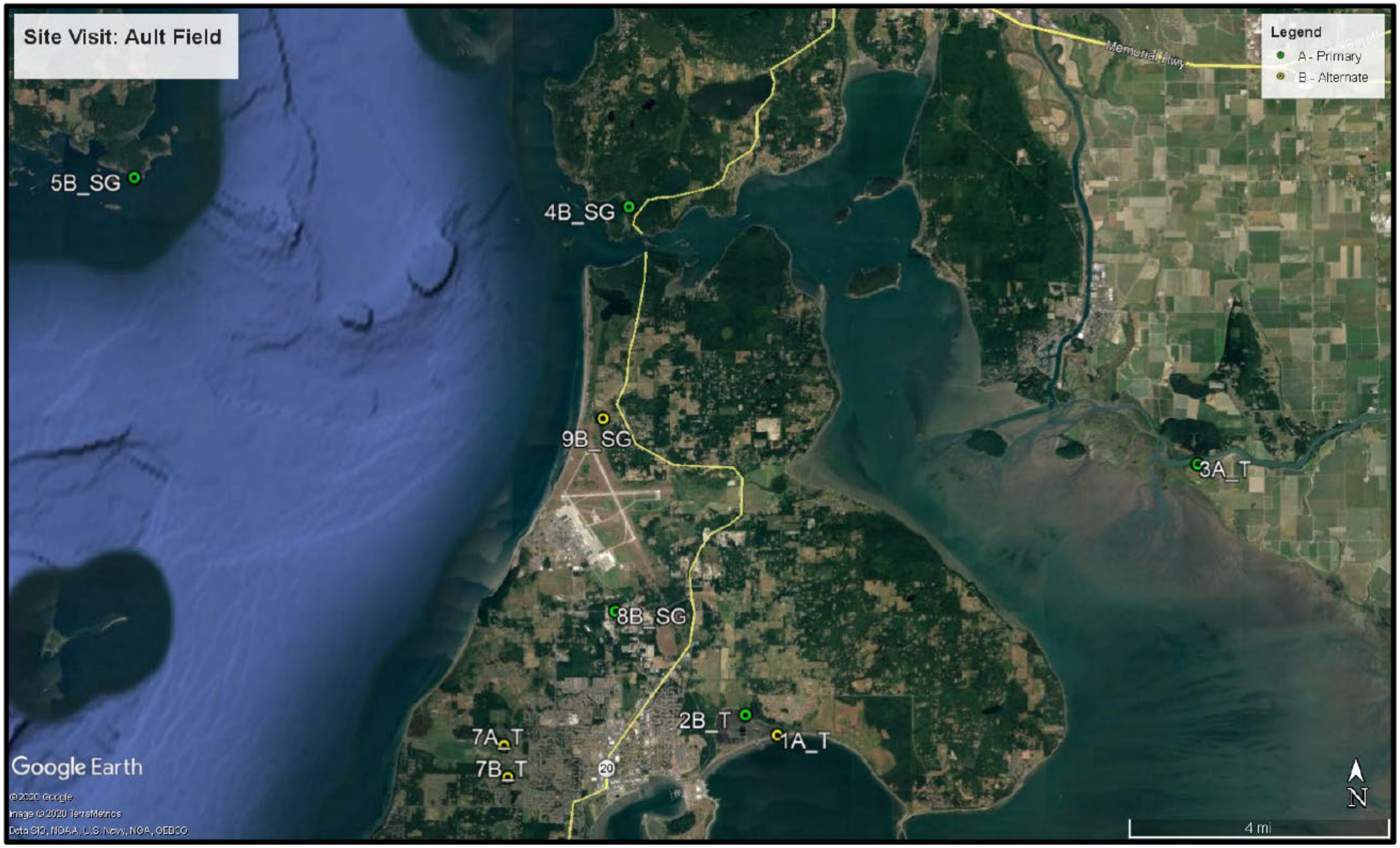


Figure 1. Primary and Alternate Sites Reviewed for Ault Field

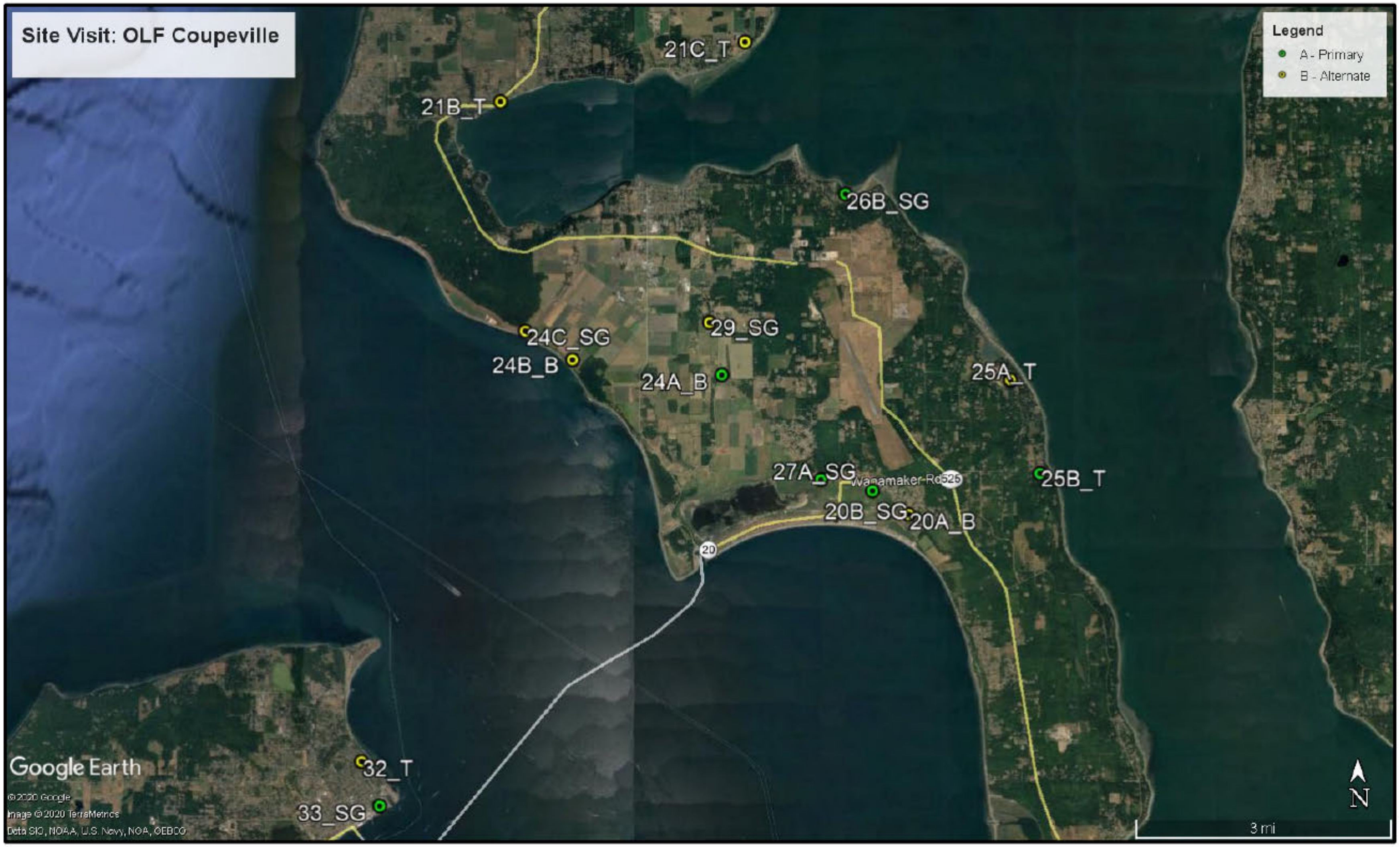


Figure 2. Primary and Alternate Sites Reviewed for NOLF Coupeville

Locations Near Ault Field and NOLF Coupeville

The BRRC team met with [redacted], NASWI CPLO, to review the primary and alternate SLM positions near Ault Field and NOLF Coupeville on 24 and 25 August 2020.

The following is a summary of the primary locations reviewed near Ault Field:

- *Seaplane Base (site 2B_T)* is within NASWI property. The actual location for this monitoring position will be adjusted 700 feet to the southeast to allow for better access from a service road controlled by NASWI. Because the site is located on NASWI property, no further action is needed to secure site access.
- *Skagit River Dike (site 3A_T)* provides an open location beyond public access, with minimal nearby sound sources. A SLM could be secured to trees along the shoreline. ***Next Action -*** NASWI CPLO will finalize access agreements with Skagit Dike District.
- *Bowman Bay – Deception Pass State Park (site 4B_SG)* is located near a park employee residence in an open area beyond the public park lands. Although the nearby park area may generate some sounds during daylight hours, they will not interfere with measurements of the aircraft overflight sounds. ***Next Action -*** NASWI CPLO will finalize access agreements with the state park.
- *North Whidbey Parks & Recreation (site 8B_SG)* will be located on NASWI property adjacent to a park. The actual location for the SLM position may be up to 1,500 feet to the west of the initially identified location. Because the site is located on NASWI property, no further action is needed to secure site access. ***Next Action -*** BRRC is evaluating the exact location to ensure the revised site falls within the siting criteria.

The following is a summary of the alternate locations reviewed near Ault Field:

- *Seaplane Base (site 1A_T)* is not needed due to the suitability of site 2B_T, discussed above.
- *Oak Harbor CRC (site 7A_T)* would work well as a back-up monitoring site. For the security of the SLM at this location, the unit would need to be placed on a rooftop. ***Potential Next Action*** - [redacted]
- *Whidbey Golf & Country Club (site 7B_T)* is not needed due to the suitability of alternate site 7A_T, Oak Harbor CRC.
- *Corner of Banta Road and Nortz Road (site 9B_SG)* would be located just inside NASWI property near this intersection. This site is an acceptable alternate, but it is not required at this time.

The following is a summary of the primary location reviews for NOLF Coupeville:

- *Admirals Cove: Perry House (site 20B_SG)* is a residence for interns for a local land trust. The initial review of this location raised concerns regarding the security of the SLM equipment since there is not a fenced area away from the house (and thus, away from reflections). The trust states that they will find a secure location for the SLM. ***Next Action -*** [redacted] NASWI CPLO will finalize the access agreement with the local land trust.
- *NPS Reuble Farm (site 24A_B)* provides a suitable and secure location. This site has low visitation, if any, from the public. The SLM will be placed in an out-of-the-way location that can still be observed by NPS personnel during the day. ***Next Action –*** BRRC will apply for a NPS research permit, which is required to obtain the access rights to this location.

- *Farm SE of NOLF Coupeville (site 25B_T)* is located within a suitable and quiet neighborhood. The farm residence has llama and sheep in the desired area for the SLM. Other areas on the property should work well, although these areas are down a steep slope. Alternate locations are possible near houses on the uphill side of the road. ***Next Action –*** (b) (5) [redacted]
- *Reeder Bay LLC parcel (site 26B_SG)* is an open and quiet area. However, this property has a recent "For Sale" sign. Other nearby residences may provide alternate locations in this area. One potential nearby site is a vocal opponent of NASWI. ***Next Action –*** (b) (5) [redacted]
- *Town of Coupeville – Water Treatment Plant (site 27A_SG)* is a secure and quiet location. The equipment noise is minimal and acceptable for the objectives of this sound study. The SLM will be placed on top of a fenced in water tower. ***Next Action -*** NASWI CPLO will finalize access agreements with the town of Coupeville.
- *Port Townsend City Hall (site 33_SG)* is located in the Historic Downtown District. The SLM will be located on top of the building roof. No noise generating equipment is on or near the roof. Additionally, the SLM can be positioned to minimize local traffic noise. This location will be better served with a semi-permanent SLM to assist in reduction of travel time during the monitoring periods. ***Next Action -*** NASWI CPLO will finalize access agreements with the city of Port Townsend.

The following is a summary of the alternate locations reviewed for NOLF Coupeville:

- *Admiral Drive & Byrd Drive (site 20A_B)* is in the Admiral Cove neighborhood, which has several residences. Yet, each lot is small with no large fenced in areas. This site is not needed due to the suitability of site 20B_SG, discussed above
- *Penn Cove Pottery (site 21B_T)* is along busy State Route 20 with noticeable traffic noise. Additionally, this site has limited space and appeared to be busy with customers. This site is not needed because site 21C_T, discussed below, offers a better alternate site.
- (b) (6) [redacted] *Farm (site 21C-T)* is a suitable alternate site with adequate security for the SLM behind fenced-in areas within the farm property. ***Potential Next Action -*** (b) (5) [redacted]
- *NPS Ferry House (site 24B_B)* is a suitable alternate site with a low visitation rate. A SLM could be placed near the house and secured by chain. ***Potential Next Action -*** (b) (5) [redacted]
- *Ebey's National Preserve – Bluff Trail (site 24C_SG)* is not required because of the suitability of the NPS Ferry House (site 24B_B). This site also has a much higher visitation rate.
- *Private Residence (site 25A_T)* provides a suitable alternative to site 25B_T although it is in a higher DNL band. The open farming area at this location would provide a secure location for the SLM because it cannot be observed from the local road. ***Potential Next Action -*** (b) (5) [redacted]

- *Rose Hip Farm – Crockett Lake Prairie (site 29_SG)* is not required because of the suitability of the NPS Reuble Farm site (site 24A_B).
- *Jackson Street, Port Townsend (site 32_T)* is not required because the City Hall site (site 33_SG) is suitable for monitoring at Port Townsend.

Locations on Lopez Island and Olympic National Park

Potential site locations on Lopez Island and Olympic National Park were conducted separately from the other primary and alternate sites due to their distance from NASWI. (b) (6) [redacted] visited Lopez Island while (b) (6) [redacted] visited ONP in separate teams on 26 August 2020. For the Lopez Island site visit, the team met with (b) (6) [redacted] of the Bureau of Land Management (BLM) to review the primary site at Point Colville as well as another nearby site south of Agate Beach Park near Iceberg Point. The position at Point Colville is adjacent to the tree line yet offers sufficient solar power and cell coverage, as well as a remote location for security. The Iceberg Point position is less suitable due to the greater distance from overflight activity. ***Next Action -*** NASWI CPLO will finalize access agreements with BLM for the Point Colville site.

Logistically, travel to Lopez Island required approximately 12 hours because of the Washington State Department of Transportation (WSDOT) ferry schedule. ***Next Action –*** NASWI CPLO and BRRC are exploring optional transportation to this site, such as charter aircraft or charter boats.

(b) (6) [redacted] visited two areas within ONP: Hoh Rainforest Visitor Center and the Barnes Point area. The Hoh Rainforest area is characterized by tall dense forest in the general area of the visitor center, which will limit solar power for the semi-permanent SLM. The only potential position at this location is around the maintenance shop area. For the review of locations within the Barnes Point area, (b) (5) [redacted] was joined by (b) (6) [redacted] Review efforts were hampered by the cancelled meeting with NPS personnel. (b) (6) [redacted] arranged a teleconference with (b) (6) [redacted] (NPS) to describe potential locations around Lake Crescent. Following this call, BRRC reviewed potential and explored a nearby trail. The sites were heavily visited by tourists, even during midday on a Wednesday. Additionally, the trail was fully covered by the forest canopy, making solar power infeasible. A superior location on Barnes Point may be the Nature Bridge area, although it was closed during this site visit. This location appears to have some NPS work facilities that are not part of public areas. ***Next Action –*** Navy Team needs to coordinate with NPS to secure a monitoring location within ONP.

Summary Status of Sound Monitoring Sites

Table 3 and Table 4 provide a summary of the SLM site statuses for Ault Field and NOLF Coupeville, respectively. Green indicates that the referenced SLM site is suitable and ready for finalization. Yellow indicates that the site is suitable if the identified issue can be resolved. Orange indicates that the suitability of the site is in doubt. White indicates that the site is either not needed and/or not suitable.

Table 3. Summary Status of SLM Sites at Ault Field

Group	Site ID	Name	Status
Primary	2B_T	Seaplane Base	Suitable; no further action needed
	3A_T	Skagit River Dike	Ready to finalize with Skagit Diking District
	4B_SG	Bowman Bay - Deception Pass State Park	Ready to finalize with Deception Pass State Park
	5B_SG	SE Lopez Island at Point Colville – BLM Land	Ready to finalize with BLM
	8B_SG	North Whidbey Parks & Rec (across on NASWI property)	Suitable; BRRC evaluating final location on NASWI property
Alternate	1A_T	Seaplane Base	Not needed
	7A_T	Oak Harbor CRC	Suitable alternate, if required
	7B_T	WGCC	Not needed
	9B_SG	Corner of Banta Rd & Nortz Rd	Suitable alternate, if required

Table 4. Summary Status of SLM Sites at NOLF Coupeville

Group	Site ID	Name	Status
Primary	20B_SG	Admirals Cove Alternative: Perry House	Need to determine secure SLM location on property
	24A_B	NPS Reuble Farm	Ready to finalize with NPS, Research Permit Required
	25B_T	Residence	Need to explore nearby residences as alternatives
	26B_SG	Reeder Bay LLC parcel	(b) (5) [redacted]
	27A_SG	Town of Coupeville - Water Treatment Plant	Ready to finalize with Town of Coupeville
	33_SG	Port Townsend Historic Downtown District - City Hall	Ready to finalize with Port Townsend City
Alternate	20A_B	Admiral Dr & Byrd Dr	Not needed
	21B_T	Penn Cove Pottery	Not a suitable alternate site
	21C_T	(b) (6) [redacted] Farm	Suitable alternate, if required
	24B_B	NPS Ferry House	Suitable alternate, if required
	24C_SG	Ebey's National Preserve - Bluff Trail	Not needed
	25A_T	Residence	Suitable alternate to Residence at 25B_T site, if required
	29_SG	Rose Hip Farm-Crockett Lake Prairie	Not needed
	32_T	Jackson Street, Port Townsend	Not needed

Pilot and ATC Interviews

The BRRC-Leidos team conducted virtual interviews on 27 August 2020 with EA-18G pilots from the following squadrons:

Fleet	VAQ 140th	LT [redacted] and VAQ 137th [redacted]
FRS	VAQ 129th	[redacted] and [redacted]
Expeditionary	VAQ 134th	[redacted] and LT [redacted]

These interviews focused on the flight profiles for the various flight operations conducted at Ault Field and NOLF Coupeville. The information obtained from these interviews will be compiled and sent back to the pilot for their review and approval. ***Next Action –*** BRRC will evaluate and compare these profiles to the previously modeled ones. Some initial differences were noted, but their effect on the modeled noise contour will have to be examined in detail before conclusions can be made.

The BRRC-Leidos team conducted a second round of discussion on 28 August 2020 with [redacted] regarding real-time operational data collection. This review included the sample data that [redacted] obtained during a week of operations at Ault Field (no operations were conducted at NOLF Coupeville during this period). The data provide a significant portion of the operational data necessary for documenting actual flight operations during the monitoring periods. However, the dataset does not provide all operational data required. To supplement this dataset, supplemental operational data will need to be collected during the sound monitoring periods, such as break points and initial departure turns, via a computer program installed on a PC tablet entitled “Flight Observation.” [redacted] reviewed the Flight Observation program and he determined that ATC would prefer to use their existing procedures for data collection. LCDR did state that a BRRC-Leidos team member could collect the necessary supplement data in the control tower during the monitoring period. ***Next Action –*** BRRC and NASWI will finalize real-time operational data collection procedures.

Observing Current Flight Observations

The team conducted field observations on 27 August 2020 around Ault Field and NOLF Coupeville to gain an appreciation of the flight operations, flight tracks, and potential observation locations. A summary of potential observation locations is provided in Table 5. The best observation location is from the ATC tower. ***Next Action –*** none

(b) (5) [redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]		[redacted]	[redacted]
[redacted]	[redacted]		[redacted]	[redacted]
	[redacted]		[redacted]	
[redacted]	[redacted]			[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	
	[redacted]			
[redacted]	[redacted]	[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]	[redacted]	

MEMORANDUM OF AGREEMENT

BETWEEN

BLUE RIDGE RESEARCH AND CONSULTING, LLC

AND

THE CITY OF PORT TOWNSEND

This Memorandum of Agreement (MOA) is made and entered into as of the date of the last signature affixed below between the Blue Ridge Research and Consulting, LLC (hereafter "BRRC") and the City of Port Townsend (hereafter "City"). This Agreement is adopted to enable operation of a sound level meter and weather monitor at the Port Townsend City Hall (hereafter "City Hall") located at 250 Madison Street, Port Townsend, WA 98368.

1.0 Purpose

BRRC seeks to monitor, evaluate, and analyze noise and noise-related weather in the Port Townsend area.

2.0 BRRC Responsibilities:

Purchase, install, and maintain a semi-permanent sound level meter and weather monitor on the roof of City Hall at a mutually agreed upon location. BRRC will coordinate with the City for the installation of the meter. BRRC will locate the meter on the roof of City Hall so that it is not visible from the street and so it will not interfere with City Hall's historic character. In installing the meter, BRRC will affix it with material that will not require nails, screws, or other items to penetrate the roof of City Hall. BRRC will be solely responsible for the meter and will hold the City harmless from any damage to the meter caused by the elements or other acts of nature.

BRRC will install the meter during normal City working hours (Monday through Friday 8:00 am to 5:00 pm). BRRC will give the City 24 hours' written notice prior to accessing the meter for installation, maintenance, or removal. BRRC will remove the meter by 30 November 2021 unless the parties agree to extend this agreement in writing. At the end of the metering period, BRRC will remove the meter and restore the location of the meter to as good of condition as prior to the installation.

3.0 City Responsibilities:

The City will allow BRRC representatives reasonable access to City Hall during normal business hours to install, maintain, and monitor the semi-permanent meter. The parties anticipate that BRRC will need to access the meter six to ten times. The City will provide an agreed upon location for the equipment. The City may remove the meter if the City finds, in its sole discretion, that the meter is damaging City Hall or the needs of the City require its removal. The City will endeavor to give BRRC ten days' written notice prior to removing the meter so that BRRC may relocate it to a mutual agreed upon location.

4.0 Hold Harmless/Indemnification

BRRC shall defend, indemnify and hold harmless the City, its officers, officials, employees and volunteers from and against any and all claims, suits, actions, or liabilities for injury or death of any person, or for loss or damage to property, which arises out of the use of City Hall or from any activity, work or thing done, permitted, or suffered by BRRC in or about the City Hall, except only such injury or damage as shall have been occasioned by the sole negligence of the City.

5.0 Term

The term of this agreement is for two years beginning on the date of the last signature affixed below.

6.0 Contacts

City of Port Townsend:
[redacted]
City Hall
250 Madison Street
Port Townsend, WA 98368
[redacted]@cityofpt.us
[redacted]

Blue Ridge Research and Consulting, LLC:
[redacted]
29 N Market St
Suite 700
Asheville, NC 28801
[redacted]@BlueRidgeResearch.com
[redacted]

IN THE WITNESS WHEREOF the parties hereto have caused this agreement to be executed.

City [redacted]

[redacted]

Date: 10-12-20

[redacted]

Date: 5 October 2020

Approved as to form:

[redacted]

[redacted] City Attorney

CATEGORICAL EXCLUSION DOCUMENTATION
FOR
Sound Testing Around Naval Air Station Whidbey Island, Washington

PROPOSED ACTION/PROJECT DESCRIPTION

The Secretary of the Navy was directed to conduct real time sound testing at two west coast Naval Air Stations. Testing equipment is temporary in nature and includes a tripod with microphone and small pelican case containing a battery/solar unit. Testing equipment is self-contained and will be deployed for a week and then removed until the next season. Four, one-week metering sessions (one for each season) are planned over the course of the next year, Nov 2020 to Nov 2021. Detailed project description and location of the monitoring sites are found in Attachment 1.

APPLICABLE CATEGORICAL EXCLUSION

Based on a review of the proposed action, NAS Whidbey Island has determined that it would not have a significant effect on the human environment individually or cumulatively, and therefore does not require preparation of an Environmental Assessment (EA) or Environmental Impact Statement (EIS). The Categorical Exclusion applicable to the proposed action is Number 17:

> Studies, data, and information gathering that involve no permanent physical change to the environment (e.g., topographic surveys, wetlands mapping, surveys for evaluation environmental damage, and engineering efforts to support environmental analysis).

FACTS SUPPORTING USE OF APPLICABLE CATEGORICAL EXCLUSION

The proposed action would be temporary in nature and would result in no ground disturbance.

CATEGORICAL EXCLUSION CRITERIA

In accordance with Paragraph 10-3-14.c of OPNAV M-5090.1 (3 Sep 2019), the following is an analysis of the applicability of exceptions to the use of **Categorical Exclusions.** The Categorical Exclusion would **not** be used if the proposed action:

(1) Would adversely affect public health or safety.

The proposed action would occur on 10 sites that have limited public access.

(2) Involves effects on the human environment that are highly uncertain, involve unique or unknown risks, or which are scientifically controversial.

The proposed action would involve placing self-contained sound meters, for one week, in various locations. There would be no unique or unknown risks, nor would the proposed action be scientifically controversial.

(3) Establish precedents or makes decisions in principal for future actions that have the potential for significant effects.

The proposed action would not result in future actions.

(4) Threaten a violation of Federal, State, or local environmental laws applicable to the Department of the Navy.

The proposed action complies with environmental laws and regulations.

(5) Involve an action that, as determined in coordination with the appropriate resource agency, may:

(a) Have an adverse effect on Federally-listed endangered and threatened species or marine mammals.

The proposed action will not affect federally listed threatened or endangered species or marine mammals. Consultation with the resource agencies is not required.

(b) Have an adverse effect on coral reefs or on Federally-designated wilderness areas, wildlife refuges, marine sanctuaries, or parklands.

The proposed action would not affect the subject resources.

(c) Have an adverse effect on the size, function or biological value of wetlands and is not covered by a nationwide or regional permit.

The proposed action is not located within wetlands or waters of the U.S.

(d) Have an adverse effect on archaeological resources or resources (including but not limited to ships, aircraft, vessels and equipment) listed or determined to be eligible for listing in the National Register of Historic Places.

NASWI Cultural Resources Program Manager determined this project has No Potential to Cause Effects to Historic Properties and documented determination in a Memorandum of Record.

(e) Result in an uncontrolled or unpermitted release of hazardous substances or require a conformity determination under the standards of the Clean Air Act General Conformity Rule.

The action is not expected to result in the release of hazardous substances and mitigations and BMPs are in-place to prevent a release. This action does not require conformity determination with the Clean Air Act General Conformity Rule.

For further information on this document, please contact Doug Lister, Environmental Planner, at (360) 396-0056.

Retention: This document shall be retained for a period of not less than 5 years.

Conditions:

- The project proponent shall advise of any changes in the proposed action. This CATEX is null and void if there are any substantial changes to the Proposed Project.
- The project should commence within 5 years of signature date.

APPROVAL RECORD

APPROVED BY: (b) (6) [redacted] 05Oct2020
Date

(b) (6) [redacted]
Installation Environmental Program Director
NAS Whidbey Island

Attachment:
(1) Memorandum from Commanding Officer Naval Air Station Whidbey Island Requesting Right of Entry for NDAA Aircraft Sound Monitoring

DEPARTMENT OF THE NAVY
NAVAL AIR STATION WHIDBEY ISLAND
3730 NORTH CHARLES PORTER AVENUE
OAK HARBOR, WASHINGTON 98278-5000

11011
Ser N46/1498
25 Sep 20

From: Commanding Officer, Naval Air Station Whidbey Island
To: Commanding Officer, Naval Facilities Engineering Command Northwest
Via: Commander, Navy Region Northwest (N4)

Subj: REQUEST RIGHT OF ENTRY FOR NDAA AIRCRAFT SOUND MONITORING

Ref: (a) P-73 NAVFAC Procedural Manual, Ch.14
(b) SECNAVINST 11011.47D
(c) OPNAVINST 5090.1C
(d) CNIC Delegation of Real Estate Requirement Approval Authority ltr of 13 Apr 17

Encl: (1) Map of sound level meter locations around Ault Field and OLF Coupeville
(2) Map of sound level meter location in the Olympic National Park

1. Per references (a) through (d), a right of entry agreement is required to allow access of ten sites for the installation of sound level meters (SLM) in support of a real-time sound monitoring study. Naval Air Station (NAS) Whidbey Island has a requirement per the Fiscal Year 2020 National Defense Authorization Act to access and install SLMs on the properties seen in enclosure (1). Properties consist of three federal sites, one state site, two city/town government sites, one county diking district, and three private residences.

2. The Secretary of the Navy was directed to conduct real-time sound monitoring at two west coast Navy airfields. The Navy has chosen NAS Whidbey Island as one of the locations. The Navy plans to conduct sampling over four (4) seven-day sampling periods, one in each season, between November 2020 and November 2021. The equipment is temporary in nature and consists of a standard tripod with a microphone attached about five feet high and connected to a small solar panel battery pack. Personnel would set up the equipment just prior to the week of study, most likely before Sunday, and then remove it the following Sunday.

3. The rights of entry are requested to begin 20 November 2020.

4. NAS Whidbey Island certifies that, per reference (c), the use of the entries will insure compliance with environmental laws and regulations.

5. Per paragraph 3.c of reference (d), Commander, Navy Region Northwest has authority to approve the requested real estate action.

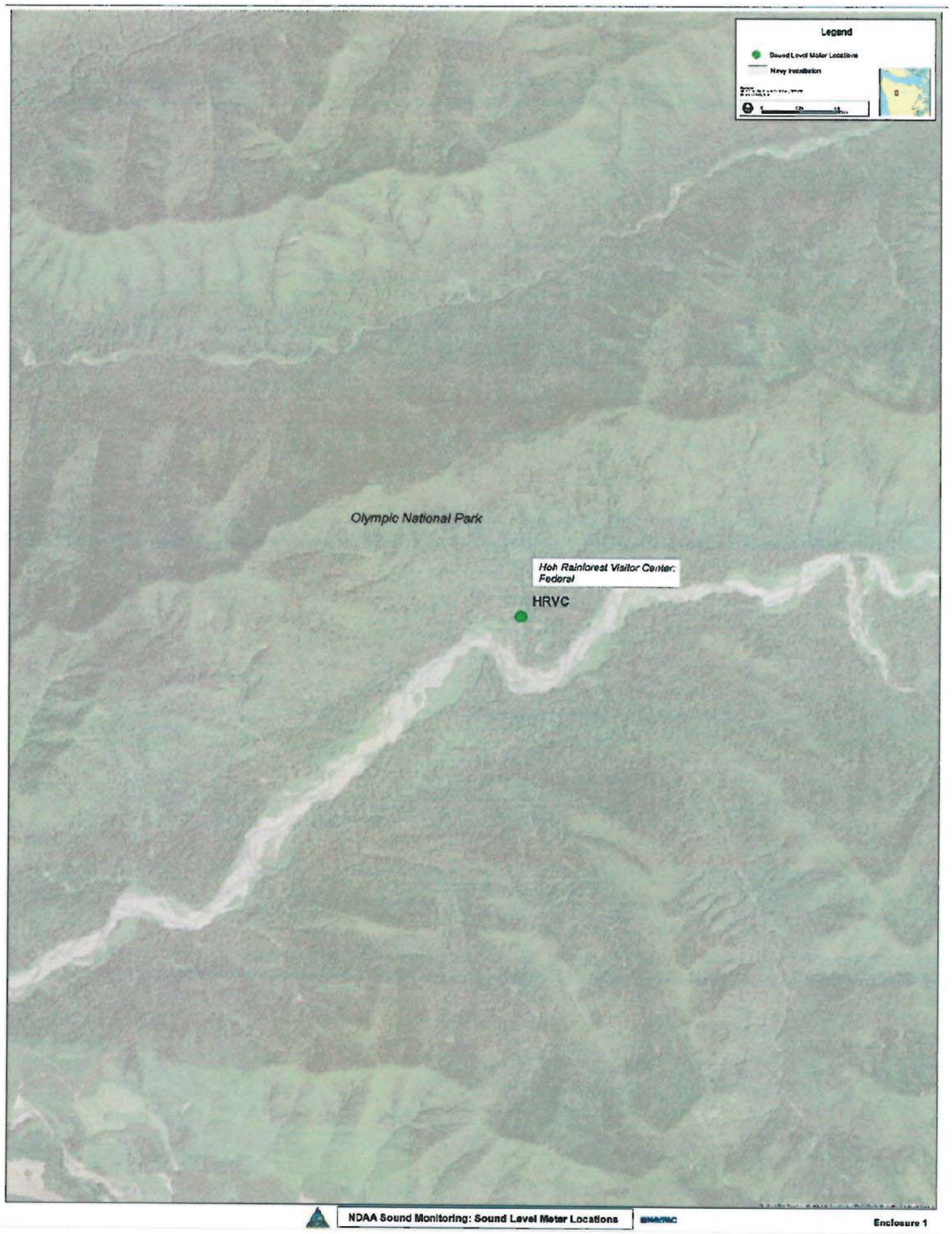
6. The NAS Whidbey Island point of contact for this project is [redacted] who may be reached at 360-257-1005, or email at [redacted]@navy.mil.

M. L. ARNY

Ault Field and Outlying Field Coupeville Sound Meter Locations

Enclosure (1)

Olympic National Park Sound Meter Location



Enclosure (2)

Attachment 1

Sound Monitoring

From: [redacted]@usda.gov>
Sent: Wednesday, June 17, 2020 2:35 PM
To: Sound Monitoring
Subject: [Non-DoD Source] Forest Service Site Location
Attachments: Permit Map.pdf

Hi,

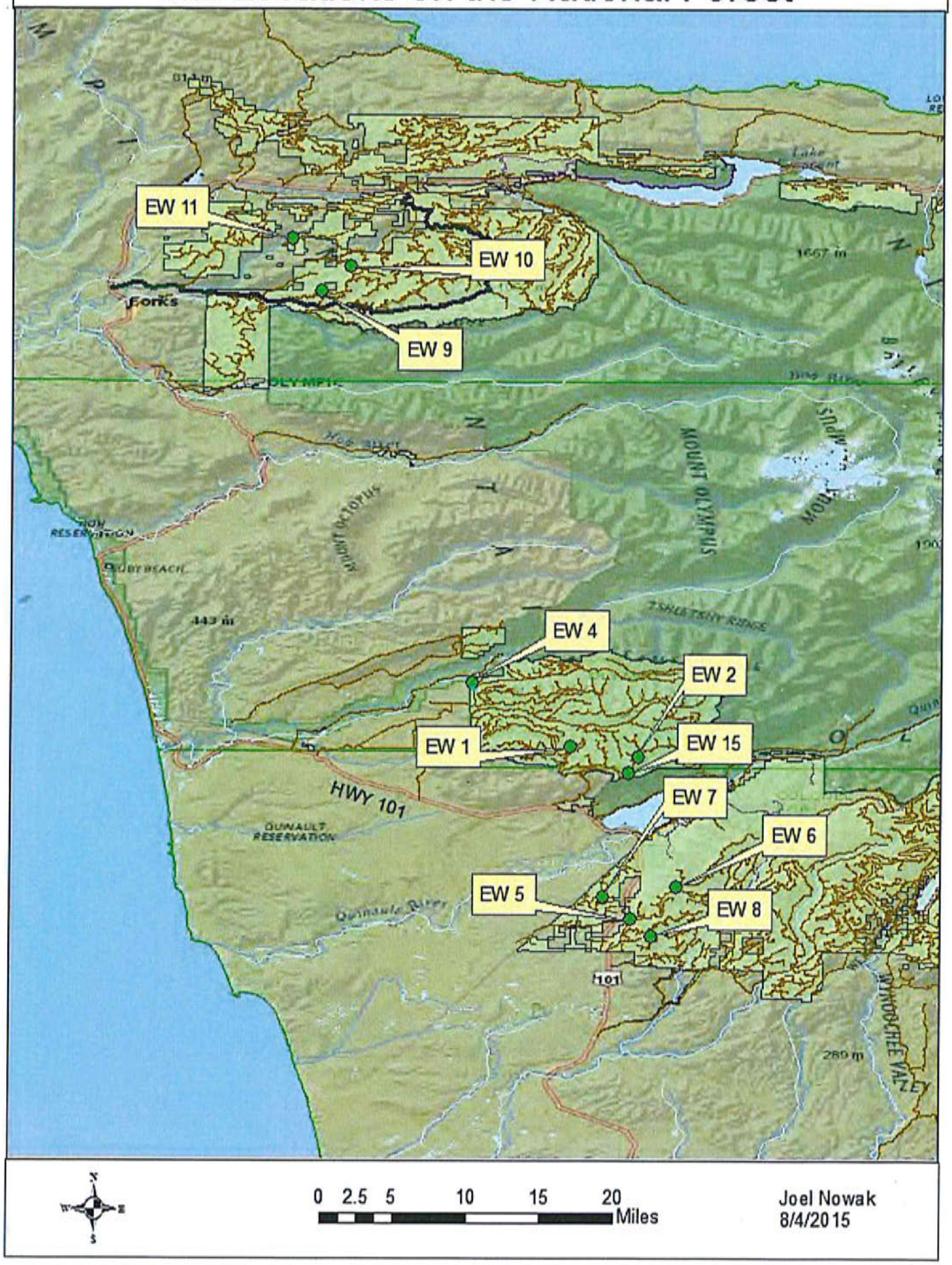
I administer the Navy Electronic Warfare special use permit for the Olympic NF. As was mentioned in our government to government meeting, I would like to suggest that a site be located somewhere in the MOA and on Forest Service land. At the meeting you described why you are not considering FS land (you only have a limited number of monitoring devices and they need to be in higher dBA range), but I still feel it would benefit the study to have a site located on FS land. Your model predicts a level of under 50 dBA for the west side of the Olympic NF, so wouldn't it be necessary to have a noise monitor in this location in order to verify the model? I realize you could calculate it out if you have data from other dBA levels, but it would miss the point of the study. Would it not be beneficial to have sound meters throughout the predicted decibel level range? As far as I know, you are not proposing one anywhere in the <50 dBA range, and as you know, any artificial noise in quiet forest environment can be much more disturbing than that same level in a populated area.

I would suggest having one in proximity to one of the more frequently used EW sites, such as site number 5 or 15 (see attached map), and monitor it consistently for one year, as you propose to do on the Olympic NP. These sites are remote, but have relatively easy access and are secure if placed in a hidden location. A site at one of these locations would serve the other purpose of gathering data for reissuance of the EW permit, since noise was one of the primary reasons the public was against it.

Thanks for your consideration,
[redacted]

[redacted]
Lead Natural Resource Specialist
Forest Service
Olympic National Forest
[redacted]
1835 Black Lake Blvd. SW
Olympia, WA 98512
www.fs.fed.us
Caring for the land and serving people

Exhibit A
Navy Electronic Warfare
Site Locations on the National Forest



Sound Monitoring

From: [redacted]@islandcountywa.gov>
Sent: Wednesday, June 17, 2020 5:51 PM
To: Sound Monitoring
Cc: Arny, Matthew L (Flounder) CAPT USN NAS WBY WA (USA); [redacted]
Subject: [Non-DoD Source] Public Input Sound Level Monitoring Sites
Attachments: SLM Sites.docx

Dear Sir or Madam,
Thank you for your outreach to the community to gather public input on site locations for monitors. Please see the attached document for input from Island County. In this process, I note the stakeholder process used to gather input. I have made recommendations for Outlying Field and Ault Field and included sites in Skagit County (Bowman Bay), San Juan County (Lopez Island) and Jefferson County (Port Townsend) in recognition of their partnership and impact in this issue. I have roughly listed the locations in a stack rank of priority. We also would like to acknowledge some remaining questions and our desire to have either more equipment or site locations if possible. Please do not hesitate to call or email if you have any questions. We appreciate this opportunity to offer input.
Thank you,
[redacted]

[redacted]
Island County Commissioner
1 NE 7th Street, PO Box 5000
Coupeville, WA 98239
[redacted]
www.IslandCountyWA.gov

Email is subject to public disclosure requirements per RCW 42.56

June 15, 2020 FINAL

To: Department of the Navy

Re: Sound Level Monitoring Study: Suggested Locations

Submitted by: [redacted], Island County Commissioner

Process:

1. Discussed at Island County Board Meeting
2. Gathered input from community groups and individuals
    a. Dugualla Bay Community
    b. Admirals Cove Community
    c. Sound Defense Alliance
    d. Ebey's National Preserve
    e. Washington State Parks
    f. Whidbey Camano Land Trust
    g. Individual constituents via email, phone or in person
3. Spoke with other elected officials representing Island County
4. Mapped out input on a large map
5. Re-engaged groups and elected officials following NASWI meeting on June 10.
6. Collated input to selected site recommendations

Site Recommendations:

I. OLF
    a. Rhododendron Park – Island County Property
    b. Ebey's National Preserve
        i. Reuble Farm
    c. Admiral's Cove –
        i. Admiral Dr & Byrd Dr - Neighborhood input to place monitor near bus stop in County ROW or nearby property

        Alternative: Perry House – R13113 – 060 – 1980; owned by Whidbey Camano Land Trust-restricted easement purchased by the Navy

    d. Prairie Center, Coupeville
        i. Ebey's Academy – 140 Terry Rd
    e. Kineth Point – suggested properties are "private properties"
        i. 250 Kineth Point Place – Property owner approval granted.
        ii. Reeder Bay LLC – open site, easy access; parcel S8535 – 00
    f. Crocket Lake –
        i. Town of Coupeville – Wannamaker and Keystone Hill; R13114-250-4610 (Restricted easement purchased by Navy)

II. Ault Field
   a. East - Dugualla Community Club LLC – Parcel R23317 – 490 – 2400; End of Beacon View Rd. Access is private property; meets logistics requirements. Community leaders expressed willingness for SLM site placement
   b. North - Bowman Bay - Deception Pass State Park; Fidalgo Island – Washington State
   c. Clover Valley – South of Ault Field
      i. Clover Valley Early Learning Center (ECEAP) -or-
      ii. North Whidbey Parks & Rec; Parcel R13323 – 026 – 0730
   d. North Ault Field (close in)
      i. Banta Rd/SR20/Northgate Drive – Private Properties -or-
      ii. Parcel R13310 - 264- 3690 Corner of Banta Rd & Nortz Rd; USA WINAS

III. Off Island County
   a. San Juan County – Lopez Island
   b. Jefferson County – Port Townsend

Objections to SLM sites on outer edges of flight paths such as Fir Island, Conway or Camano Island unless we can obtain more equipment or sites.

Questions:

1. What is the possibility of additional sites or equipment; rotation of equipment if no new equipment available?
2. Will the study monitor and report full range of common noise – include ambient/background noise, A and C weighted noise (hearing v. tissue impact); including circumstances during monitoring including weather?
3. Will the sound data monitoring be a blind study?
4. Will the study report exact data, not just bands?

Respectfully submitted,

[redacted] Island County Commissioner
[redacted]

Sound Monitoring

From: [redacted]@co.jefferson.wa.us>
Sent: Friday, June 19, 2020 3:50 PM
To: Sound Monitoring
Subject: [Non-DoD Source] Growler Noise Monitoring
Attachments: Growler Noise Monitoring.pdf

Please find attached the letter from Jefferson County Board of County Commissioners.

Thank you,

[redacted]
Executive Secretary II, Jefferson County Commissioners Office
[redacted]

Email may be considered a public record subject to public disclosure under RCW 42.56

Board of County Commissioners
1820 Jefferson Street
PO Box 1220
Port Townsend, WA 98368

(b) (6) [redacted], District 1 (b) (6) [redacted] District 2 (b) (6) [redacted] District 3

June 15, 2020

To: Captain Matthew Arny

From: Jefferson County Board of County Commissioners

Thank you for taking suggestions on placement of noise monitoring equipment as per the National Defense Authorization Act. Many residents of Jefferson County, particularly in Port Townsend and on the West end, are impacted by noise from the Growler jets and appreciate the opportunity to obtain better data.

We would like to make a few suggestions regarding this noise monitoring to make it a worthwhile effort to address the concerns of our constituents, partners and environment.

1. **Measure all decibel levels as well as frequencies.** Your plan indicates that most monitoring will be done in areas where the decibel levels are between 60-75 decibels. Yet, in a December 9, 2016 Peninsula Daily News article, a Navy official confirmed that Port Townsend generally experiences Growler noise at 80-85 decibels. On our call earlier this week, one of your team referred to this level as "inconsistent with most land uses". We request accurate, real-time decibel levels be measured in Port Townsend and be compared to the modelling used in the Environmental Impact Statement in 2017.

   Also, sound is experienced differently depending on frequency. For years we have received public comment that the low frequency sound produced by Growler jets is particularly distressing to people with sensory disorders, PTSD, and other health conditions, and also highly aggravating for citizens with none of these conditions as well. These low frequency sound waves travel long distances and cannot effectively be screened out by walls or windows at night when much of the training occurs at the Outlying Field. The volume of this low frequency noise is also highly disruptive to many or the outdoor activities our residents cherish and that our visitors come here to experience in Port Townsend and on the Olympic Peninsula. The previous aircraft based at Whidbey NAS did not have the disturbing noise footprint associated with this low frequency sound. We ask that frequency also be monitored and analyzed as part of this study in order to accurately assess potential impacts to health.

   For these reasons, all analysis should be in both A-weighted (used by FAA and DoD but eliminates low frequencies) and C-weighted (includes low frequencies).

2. **Monitor both inland, mountain locations in Olympic National Park, as well as on the coast.** The Olympic Peninsula is home to some of the most pristine, diverse and QUIET wilderness in the world. Growlers have changed this for residents, wildlife and visitors alike. These impacts vary greatly based on terrain, so therefore we ask that monitoring be done both at an inland, mountain elevation and near the coastal communities where flight paths concentrate.

(b) (6) [redacted] (b) (6) [redacted]@co.jefferson.wa.us

The Hoh and Quinault tribes, whose sovereign lands lay partially within the boundaries of Jefferson County, are heavily impacted by Growler noise and we support their request for greater consultation on mitigating these impacts. We recommend working with the coastal tribes to identify appropriate monitoring locations.

The adjacent Olympic National Park coastal strip and NOAA managed National Wildlife Area which is exists along the entire west coast of the Olympic Peninsula are unique, pristine areas have been protected for a reason. The noise level with nearby and overhead Growler flight training needs to be monitored and its impacts to wildlife assessed.

3. **Place a monitor at Fort Worden in Port Townsend.** With so many return flights directly over Port Townsend, as well as numerous inter-facility and pattern flights a mere 7 or 8 miles away at the Outlying Field, Port Townsend experiences impacts from multiple training missions. While noise has never been measured accurately here, only modeled, it is imperative that we get accurate data on how much noise is experienced by residents here, especially in a topography surrounded by water which does nothing to attenuate the Growler noise.

Also, Port Townsend's historic districts and State Park buildings were never included in the Growler Section 106 process or Area of Impact of the Growler ROD expansion, so better data is clearly needed to assess impacts.

Fort Worden is well situated to ensure a quiet and protected location, and is a major hub for camping and outdoor recreation, economic sectors that we are concerned will be affected by the ever-increasing Growler activity.

4. **Address the impacts related to the number of flight operations.** It is important to understand that to level of noise impact is related to the number of flight operations. There are times when landing practice at the Outlying Field occurs night after night, week after week, from sunset until well past 11 p.m. The increase in flight operations coupled with the stationing of this newer, louder, low frequency sound Growler aircraft at Whidbey has dramatically changed our life experience in Port Townsend and other areas of the Olympic Peninsula. The amount of time that this noise disruption occurs in our communities has routinely been downplayed by the Navy and explained as merely an incremental increase. That is not the experience that many of our citizens have reported.

5. **Process matters.** While you've indicated that local community partners were involved in the creation of the monitoring plan, Jefferson County was not consulted. We continue to ask the Navy and DOD to consult tribes, local governments and community groups when considering projects that impact their daily lives and homes.

Further, we request:

- Pre-notification of each monitoring period.
- Each monitoring period should capture at least four 45-minute sessions of Field Carrier Landing Practice training.
- All raw data recorded must be made available to the public on the internet with information on how to read the files.
- Aircrews should not modify their normal flight paths during monitoring.

6. **Commit to doing solid analysis with monitoring data.** As recommended by Washington State Department of Health in their comment submitted during your 2017 Growler EIS, previous sound modeling and impacts ignored the current state of science around noise and public health. We implore you to use the results of this current study to conduct a Health Impact Analysis using recently published epidemiological research on the health effects of noise exposure. This new data provides an opportunity to update previous assumptions for modeling and health impact conclusions.

Again, thank you for seeking input on an issue that impacts the residents, visitors and wildlife of Jefferson County. We look forward to partnering with you in getting good data and putting it to use for the benefit of our region. Please let us know if we can assist in your monitoring efforts.

Sincerely,

[redacted]

District 3 Commissioner District 1 Commissioner District 2 Commissioner

Sound Monitoring

From: Arny, Matthew L (Flounder) CAPT USN NAS WBY WA (USA)
Sent: Wednesday, June 17, 2020 7:26 PM
To: Sound Monitoring
Cc: [redacted] USN NAVFAC NW SVD WA (USA); [redacted] USN COMNAVREG NW (USA); [redacted] USN CNO (USA)
Subject: FW: Letter of Support - Real Time Sound Monitoring
Attachments: Ramel Letter - Real Time Study.docx
Signed By: [redacted] @navy.mil

Please include the attached.
Regards,

CAPT Matt Arny
Commanding Officer, NAS Whidbey Island
Commander, Northwest Training Range Complex
Office: (360) 257-2345

From: [redacted]@leg.wa.gov> **On Behalf Of** Ramel, Rep. Alex
Sent: Wednesday, June 17, 2020 3:56 PM
To: Arny, Matthew L (Flounder) CAPT USN NAS WBY WA (USA) [redacted] @navy.mil>
Cc: [redacted]@nps.gov; [redacted]@gov.wa.gov>; [redacted]@parks.wa.gov; [redacted] USN COMNAVREG NW (USA) <[redacted]@navy.mil>; [redacted] USN NAVFAC NW SVD WA (USA) <[redacted]@navy.mil>; [redacted]@cantwell.senate.gov; [redacted]@mail.house.gov; [redacted] <Amanda.Hubik@leg.wa.gov>
Subject: [Non-DoD Source] Letter of Support - Real Time Sound Monitoring

Captain Arny,

Many thanks to you and your team for facilitating the recent discussion on sound monitoring. I would advocate for the placement of a station on Lopez Island, and have written a letter of support - which is attached.

With appreciation,

Alex Ramel
WA State Representative | 40th Legislative District
Pronouns: he/him/his
Legislative Building 132D
Alex.Ramel@leg.wa.gov
Legislative Assistant: [redacted]

STATE REPRESENTATIVE
40th LEGISLATIVE DISTRICT
ALEX RAMEL

State of
Washington
House of
Representatives

COMMERCE & GAMING

HOUSING, COMMUNITY
DEVELOPMENT & VETERANS

June 17th, 2020

CAPT Matt Arny
Commanding Officer, NAS Whidbey Island
Commander, Northwest Training Range Complex
Oak Harbor, WA 98278

RE: Point Colville Testing Location

sent via electronic mail

Dear Captain Arny,

Please consider this letter of support to prioritize one testing location for Point Colville, in San Juan County, in the 40th Legislative District.

I've been hearing concerns about jet noise from residents of Lopez Island since I first expressed an interest in serving as a State Representative. I'm sure you've heard from many of the same community members. Accurate data to evaluate this noise would be extremely helpful in understanding the issue to support an informed community discussion.

Point Colville, part of the San Juan Islands National Monument on Lopez Island, meets the site location criteria outlined in the presentation on June 10th and has support from community leaders who are most vocal on this issue. I understand that there is support from the BLM Manager of the San Juan Islands National Monument.

Thank you for your continued leadership, and your willingness to hear the requests of the community members that we serve.

Respectfully,

Alex Ramel
WA State Representative, 40th Legislative District

CC: Senator Cantwell
Congressman Larsen
[redacted]
(b) (6)
(b) (6)

LEGISLATIVE OFFICE: 132-D LEGISLATIVE BUILDING • PO BOX 40600, OLYMPIA, WA 98504-0600 • 360-786-7970
E-MAIL: Alex.Ramel@leg.wa.gov
TOLL-FREE LEGISLATIVE HOTLINE: 1-800-562-6000 • TTY: 1-800-833-6388 • www.leg.wa.gov

Sound Monitoring

From: Paul, Rep. Dave <Dave.Paul@leg.wa.gov>
Sent: Tuesday, June 30, 2020 3:07 PM
To: Sound Monitoring
Cc: Paul, Rep. Dave; [redacted]@islandcountywa.gov; [redacted]mail.house.gov; [redacted]ll@cantwell.senate.gov; Arny, Matthew L (Flounder) CAPT USN NAS WBY WA (USA); [redacted]@murray.senate.gov; [redacted] USN NAVFAC NW SVD WA (USA)
Subject: [Non-DoD Source] Sound Level Monitoring Feedback
Attachments: Sound Level Monitoring letter Rep Paul.pdf

Good afternoon,
Please see the attached letter for recommended sites for sound level monitoring equipment.

Thank you, and please let me know if you need additional information.

Sincerely,

Dave

Rep. David M. Paul, Ph.D.
10th Legislative District
360-786-7914
John L. O'Brien #309
PO Box 40600
Olympia, WA 98504
Sign up for my E-Newsletter Here! https://housedemocrats.wa.gov/paul/e-newsletter/

NOTICE OF PUBLIC DISCLOSURE: Please note, this email and any documents you send this office, may be subject to disclosure requirements under the state Public Records Act, RCW 42.56.

Sound Monitoring

From:	[redacted] [redacted]@leg.wa.gov>
Sent:	Tuesday, June 30, 2020 2:18 PM
To:	Sound Monitoring
Cc:	Paul, Rep. Dave; [redacted] USN NAVFAC NW SVD WA (USA); [redacted]@mail.house.gov; [redacted]@islandcountywa.gov; Arny, Matthew L (Flounder) CAPT USN NAS WBY WA (USA); [redacted]@cantwell.senate.gov; [redacted]@murray.senate.gov
Subject:	[Non-DoD Source] NASWI Sound Monitoring Sites
Attachments:	NASWI Sound Monitoring Sites Letter.pdf

To whom it may concern,

Please find the attached letter from Representative Dave Paul regarding recommendations of NASWI sound monitoring sites.

Thank you,

[redacted]
Interim Legislative Assistant to Rep. Dave Paul | 10th LD
Temporary district office phone number [redacted]

STATE REPRESENTATIVE
10th LEGISLATIVE DISTRICT
DAVID M. PAUL, PH.D

State of
Washington
House of
Representatives

EDUCATION
COLLEGE & WORKFORCE DEVELOPMENT
TRANSPORTATION

June 29, 2020

To: Department of the Navy

Re: Sound Level Monitoring Study: Suggested Locations

Dear Sir or Madam,

I represent the 10th Legislative District in the Washington State Legislature. The 10th Legislative District is home to Naval Air Station Whidbey Island, and I am writing to provide input on site recommendations for sound level monitoring equipment. These recommendations are largely based on the work conducted by Island County Commissioner Janet St. Clair. In addition, I've collected input from community leaders, health care providers, and constituents.

I believe at least 12 sites are needed within the 10th Legislative District. Additional sound monitoring equipment is likely needed in San Juan County and Jefferson County.

I strongly recommend equipment to be located at following locations. These locations are not in order of importance.

1. Kineth Point Neighborhood (Coupeville WA 98239). Commissioner St. Clair suggested several specific properties that could serve as sites.
2. Admiral's Cove Neighborhood (Coupeville WA 98239). Commissioner St. Clair suggested two specific locations that could serve as sites.
3. Rhododendron Park (Island County Property at 502 W Patmore Rd, Coupeville, WA 98239). I recommend the equipment is placed near the softball/baseball fields.
4. Coupeville Middle School (501 S Main St, Coupeville 98239) or Ebey Academy (140 SE Terry Rd, Coupeville 98239).
5. Ebey's National Preserve. Possible locations suggested by Commissioner St. Clair include Reuble Farm, Ferry House, or the Bluff Trail.
6. Rose Hip Farm – Crockett Lake Prairie (338 Fort Casey Rd, Coupeville 98239).
7. Dugualla Community Club Neighborhood. Commissioner St. Clair suggested LLC – Parcel R23317 – 490 – 2400 at the end of Beacon View Rd.
8. Bowman Bay - Deception Pass State Park – Washington State.
9. A North Ault Field location on Banta Road. Commissioner St. Clair suggested two specific locations that could serve as sites.
10. Hand-in-Hand/HomeConnection facility operated by the Oak Harbor School District (600 Cherokee St, Oak Harbor, WA 98277).
11. Crescent Harbor Elementary operated by the Oak Harbor School District (330 E Crescent Harbor Rd, Oak Harbor, WA 98277).
12. A Fir Island, Conway, or Camano Island location.

STATE REPRESENTATIVE
10th LEGISLATIVE DISTRICT
DAVID M. PAUL, PH.D

State of
Washington
House of
Representatives

EDUCATION
COLLEGE & WORKFORCE DEVELOPMENT
TRANSPORTATION

13. A Lopez Island location (San Juan County).
14. A Port Townsend location (Jefferson County).

In addition, I understand that a sampling system consisting of 4 seasonal monitoring periods will be used to collect data. Given the unique nature of weather and wind patterns in our region, I strongly recommend that data be collected at the sites continuously for one year. Doing so will better enable the Navy to understand how wind patterns influence noise during training operations. Continuously collecting data over a year will eliminate potential criticism that the monitoring periods selected do not represent an accurate portrayal of the impact of training operations on the above neighborhoods and communities.

All data collected should be available to the public and independent researchers after the Navy's research is complete.

Please contact me if you need additional information or rationale for the site locations.

Very respectfully,

Dave Paul

Rep. David M. Paul, Ph.D.

CC. Rep. Rick Larsen
Sen. Maria Cantwell
Sen. Patty Murray
Island County Commissioner Janet St. Clair
Capt. Matthew Arny

Sound Monitoring

From: [redacted]@sanjuanco.com>
Sent: Wednesday, June 17, 2020 4:41 PM
To: Sound Monitoring
Cc: [redacted]
Subject: [Non-DoD Source] Letter from the San Juan County Council re: Noise Monitoring (attached)
Attachments: 06-17-2020 SJC Council Letter to Capt Arny re noise monitoring.docx

[redacted] *CMC*
Clerk to the San Juan County Council
[redacted]
55 Second Street
Friday Harbor, WA 98250

Mailing: 350 Court Street #1

San Juan County Council

350 Court Street No. 1
Friday Harbor, WA
98250
(360) 378 - 2898

District 1, Bill Watson
District 2, Rick Hughes
District 3, Jamie Stephens

6/17/2020

Captain Matt Arny
Commanding Officer, NAS Whidbey Island
Commander Northwest Training Range Complex

Re: Noise Monitoring Locations

Dear Captain Arny,

Thank you for the webinar briefing last week. It was very informative. We have three points to make regarding your request from us for locations:

1. We request monitoring on SE Lopez Island at Point Colville. This is part of the San Juan Islands National Monument managed by the BLM. It fits your criteria of little other ambient noise. Your office has already received permission from the BLM district office to conduct the tests there.

   It is important because that area is impacted. It is actually closer to Ault Field than Anacortes. The FAA military flights altitude graph from 2016 shows many more flight tracks over Lopez than your modeling (slide 10) or flight track map indicate (slide 12). The public does not feel the modeling is accurate especially as you move further from the airfields. If these tests are to confirm the model then Lopez Island should be included.

2. We ask that you have at least two monitoring sites on the Olympic Peninsula. One at Port Townsend and one in Olympic National Park. The peninsula topography is coastal plains on the sides and high elevations in the middle. It was stated during the webinar that the flights are too high to cause noise in excess of 50dba.

   However, referring to the altitude mapping, flights are 16,000 – 18,000 feet MSL over the Olympic peninsula. The range averages elevations around 6000 ft so the aircraft actually have a noise profile more like 10 – 12,000 ft. above ground, which is similar to Whidbey Island.

3. We ask that you modify to your arrival/departure Noise contour map to reflect actual patterns. Your map shows only a small portion of Lopez Island in the landing pattern where the FAA shows activity that is more robust over the whole island.

Best regards,

San Juan County Council
Washington

[redacted]

Rick Hughes, Chair District No. 2	Bill Watson, Vice Chair District No. 1	Jamie Stephens, Member District No. 3

Sound Monitoring

From: John Mauro <JMauro@cityofpt.us>
Sent: Tuesday, June 30, 2020 6:36 PM
To: [redacted] USN NAVFAC NW SVD WA (USA)
Cc: [redacted] USN COMNAVREG NW (USA); Arny, Matthew L (Flounder) CAPT USN NAS WBY WA (USA); Sound Monitoring
Subject: RE: [Non-DoD Source] Sound monitoring
Attachments: City of Port Townsend Growler DEIS Comment Letter.pdf; Growler Operations Comment Letter final.pdf; 20.6.30 - Growler Noise Monitoring.pdf

Thank you, [redacted].

Please see the attached letter(s) from the City. I've also copied two previous pieces of correspondence, one of which includes the historic district overlays.

Thank you for the opportunity to provide input on the location of sound monitoring locations in Port Townsend. We look forward to working with you to locate the equipment as soon as practicable.

Best wishes,
John

John Mauro | City Manager
City of Port Townsend | www.cityofpt.us
250 Madison Street, Suite 2 | Port Townsend, WA 98368
[redacted]
Follow us on Facebook: fb.me/CityofPT

From: [redacted] USN NAVFAC NW SVD WA (USA) <[redacted]@navy.mil>
Sent: Thursday, June 25, 2020 3:57 PM
To: John Mauro <JMauro@cityofpt.us>
Cc: [redacted]@cityofpt.us>; [redacted] CIV USN COMNAVREG NW (USA) [redacted]@navy.mil>; Arny, Matthew L (Flounder) CAPT USN NAS WBY WA (USA) [redacted]@navy.mil>; Sound Monitoring <soundmonitoring.fct@navy.mil>
Subject: RE: [Non-DoD Source] Sound monitoring

John,
Trying to help identify a location based on anticipated operational impacts is a little difficult for the Port Townsend area since it was less than 50 DNL in the Growler EIS noise model. For the moment the modeled DNL in the EIS is all we have with respect to sound. With that said though I think we have some other information that might help you in narrowing down locations. Attached are the flights tracks from the Growler EIS. Page 2 shows our arrival tracks over Port Townsend from aircraft returning to Ault Field from the Olympic Military Operating Areas (MOAs). It's important to keep in mind that aircraft are not going to fly this exact line every time and may be either left or right of it. However, it does show the primary routes back to Ault Field. If you need more granularity let me know and I can provide a map that is zoomed in more on Port Townsend and includes these tracks which might help with your historic building layer and community concerns overlay.

As for frequency, acoustics, topography, etc... I'll defer to the sound monitoring subject matter experts if they have any information that might help you all in proposing locations.

Regards,
[redacted]

[redacted]
NAS Whidbey Island
1115 W. Lexington St. B103
Oak Harbor, WA 98278
[redacted]

From: John Mauro <JMauro@cityofpt.us>
Sent: Thursday, June 25, 2020 11:24 AM
To: [redacted] USN NAVFAC NW SVD WA (USA) <[redacted]@navy.mil>
Cc: [redacted]@cityofpt.us>; [redacted] USN COMNAVREG NW (USA) <[redacted]@navy.mil>; Arny, Matthew L (Flounder) CAPT USN NAS WBY WA (USA) <[redacted]@navy.mil>; Sound Monitoring <soundmonitoring.fct@navy.mil>
Subject: RE: [Non-DoD Source] Sound monitoring

Thank you, [redacted] (and appreciate your response, too, Captain Arny).

By copying the sound monitoring address here, I'm hoping to get a response in order to better understand your general guidance on optimizing a location based on frequency, acoustics, topography, etc.
Or if more specific requests are required: where are the highest expected noise impacts based on those factors above? We can then overlay any information you have with our historic buildings layers, areas of greatest recorded community concerns, etc.

All best and many thanks
John

John Mauro | City Manager
City of Port Townsend | www.cityofpt.us
250 Madison Street, Suite 2 | Port Townsend, WA 98368
[redacted]
Follow us on Facebook: fb.me/CityofPT

From: [redacted] USN NAVFAC NW SVD WA (USA) <[redacted]@navy.mil>
Sent: Monday, June 22, 2020 7:50 AM
To: John Mauro <JMauro@cityofpt.us>
Cc: [redacted]@cityofpt.us>; [redacted] USN COMNAVREG NW (USA) [redacted]>; Arny, Matthew L (Flounder) CAPT USN NAS WBY WA (USA) <matthew.arny@navy.mil>
Subject: RE: [Non-DoD Source] Sound monitoring

CAUTION: External Email

Hi John,
The attached slides were from the WebEx call on 10 June. Wanted to pass them along in case you didn't have a copy. The subject matter experts and contractor for the sound monitoring effort are utilizing the following email address for questions and comments: sound.monitoring@navy.mil. You can submit questions on frequency, acoustics, topography, etc… there and the team will investigate those. Last Friday they said they received some comments from Jefferson County. If you have local questions about operations and complaints as you investigate potential sites we can talk about that with our air operations team here at NAS Whidbey Island.

v/r,
[redacted]
NAS Whidbey Island
1115 W. Lexington St. B103
Oak Harbor, WA 98278
[redacted]

From: Arny, Matthew L (Flounder) CAPT USN NAS WBY WA (USA) <[redacted]@navy.mil>
Sent: Friday, June 19, 2020 6:15 PM
To: John Mauro <JMauro@cityofpt.us>
Cc: [redacted]@cityofpt.us>; [redacted] USN NAVFAC NW SVD WA (USA) <[redacted]@navy.mil>; [redacted] USN COMNAVREG NW (USA) <[redacted]@navy.mil>
Subject: RE: [Non-DoD Source] Sound monitoring

John,
Thanks for your email. I've cc'ed [redacted] and [redacted]. [redacted] in particular can make sure he carries that message to the Navy team so we can follow up on that conversation.

I look forward to another visit when we can get together and discuss this and other issues.
Regards,
Matt

CAPT Matt Arny
Commanding Officer, NAS Whidbey Island
Commander, Northwest Training Range Complex
Office: [redacted]

From: John Mauro <JMauro@cityofpt.us>
Date: Friday, Jun 19, 2020, 5:20 PM
To: Arny, Matthew L (Flounder) CAPT USN NAS WBY WA (USA) [redacted]@navy.mil>
Cc: [redacted]@cityofpt.us>
Subject: [Non-DoD Source] Sound monitoring

Dear Captain Arny

Thank you for involving Port Townsend in the call last week. As has been discussed over the past few decades, the community remains very concerned/interested in the issue and we appreciate the opportunity to be involved in progress around sound monitoring.

I believe there was an offer made from the Navy of assistance in selecting monitoring sites locally, so I wanted to touch base on how you would suggest we do so. Based on the frequency/location of complaints we routinely get from our residents, it's clear that there are acoustical differences that aren't readily explained by topography or proximity to Whidbey or the flyover routes you've shared during the call. Given the nature of our ongoing concerns (e.g., around historic preservation and buildings), it would be extremely valuable to tap into your team's expertise and advice to ensure we optimize the location selection.

I've been made aware of the June 30th deadline for input – but since I'm not privy to direct exchanges/new information (and invitations like the June 10th call), I'd appreciate being included so I can properly coordinate and reduce requests/unnecessary burden on you and your team. Again, any near-term advice on how to work together quickly to select appropriate sites so we can provide our input by the very close approaching deadline would be much appreciated.

Many thanks and enjoy your weekend

John

John Mauro | City Manager
City of Port Townsend | www.cityofpt.us
250 Madison Street, Suite 2 | Port Townsend, WA 98368
(b) (6) [redacted]
Follow us on Facebook: fb.me/CityofPT

[redacted]
NAS Whidbey Island
1115 W. Lexington St. B103
Oak Harbor, WA 98278

30 June 2020

RE: Naval Air Station Whidbey Island Real Time Noise Monitoring

Dear [redacted]:

Thank you for the opportunity to participate in choosing the best sound monitoring locations in Port Townsend. I note the Jefferson County Board of Commissioners recommended Fort Worden as an appropriate location for sound monitoring equipment, and we support that location. I also strongly suggest that you locate equipment in Port Townsend historic downtown and historic uptown districts. Those two locations, along with Fort Worden, encompass many of the historic structures in Port Townsend. I can help with both those locations since City Hall is in the historic downtown and the City Library is in the historic uptown. Both buildings' roofs could host sound monitoring equipment. I am not a sound engineer or acoustics expert, and so I cannot speak as to whether those locations would be appropriate for the equipment. In the spirit of cooperation, however, I want you to know that the City is happy to assist in providing a secure location.

The transition from outdated computer modelling incorrectly assumed the baseline for noise impacts and failed to account for low frequency noise, therefore not correctly accounting for the impacts of expanded Growler operations in our City and throughout the Olympic Peninsula. The move to real-time sound monitoring is a significant step in the right direction in better understanding our collective challenge after many years of not feeling heard. I echo the sentiments and desires of the Jefferson County Board of Commissioners in that the sound monitoring measures decibel levels as well as frequencies, addresses the impacts related to the number of flight operations, notifies and keeps the public informed of the monitoring period and the data, and commits to a solid analysis of the data.

As you know, this issue has been an issue of long-term concern for us and our residents. We do appreciate the many women and men of the military who sacrifice for our safety and protection and certainly want our armed forces to receive the best equipment and training. We also know the value of historic preservation and our natural environment and quality of life. We look forward to finding a solution that can work for all of us. Meanwhile, please don't hesitate to contact us with questions and to begin the deployment of real-time equipment in the locations requested above.

Sincerely,

(b) (6) [redacted]

John Mauro
City Manager
City of Port Townsend

City of Port Townsend

Deborah Stinson
Mayor
250 Madison, Suite 2
Port Townsend, WA
98368
360-379-5047
dstinson@cityofpt.us

January 18, 2017

EA-18G Growler EIS Project Manager
Naval Facilities Engineering Command Atlantic
Attn: Code EV21/SS
6506 Hampton Boulevard
Norfolk, VA 23508

Dear Sir or Madam:

Thank you for the opportunity to comment on the Draft Environmental Impact Statement (DEIS) published November 11, 2016 on the addition of 36 EA-18G "Growler" jets to the fleet of 82 existing Growlers at Naval Air Station Whidbey Island (NASWI). The City previously provided scoping comments on the DEIS in its letter dated January 1, 2015. It also submitted comments and a request for Section 106 consultation on August 16, 2016.

The published DEIS does **not** address our previous comments. To summarize, our January 8, 2015 scoping comments addressed:

- The Navy's piecemeal EIS and Environmental Assessment processes for proposed Navy operations in the Military Operations Area in the Olympic National Forest do not comply with NEPA's requirement that the effects of functionally-related activities must be assessed together and the cumulative impacts of those activities addressed.
- The DEIS does not properly reflect the impacts of jet noise, pollution and other stressors to the health and well-being of our community and our neighbors on the Olympic Peninsula.

Since sending this letter, we have discovered other issues that could have direct impact on Port Townsend and our Olympic Peninsula neighbors:

- Verbal statements by Navy personnel in public meetings are still not clearly reflected in written materials. As an example, the DEIS numbers for

Growler operations do not include an additional 42 planes, as was discussed at the Navy's December open house.

- There is no mention of weekend training flights in the DEIS, but the Washington State Forest Services Draft Permit does talk about weekend flights.

Additionally, our Section 106 consultation letter addressed:

- A request that for noise impacts, the Navy expand the area of study, as well as the definition of the indirect effects component of the Area of Potential Effect (APE.)
- A request to consider using a different measure of sound impacts.
- A request to include an evaluation of all the historic areas over which the Growlers fly, not just the much smaller historic areas affected by takeoffs and landings.
- A request to enter into formal consultation with the City of Port Townsend under authority of Section 106 of the National Historic Preservation Act.

We remain concerned that the Navy continues to separate the ground, air, and sea-based activities on and around the Olympic Peninsula into different public processes. This practice of segmentation has resulted in numerous separate comment periods between January 2014 and now. As we have previously stated, we share the view of some of our constituents who do not view these electronic warfare testing, training and flight activities as separate. And, that the Navy's segmentation of impacts into numerous distinct public processes continues to cause confusion and frustration to people who are trying to piece together the full scope of impacts.

While not directly related to this DEIS, we note that this continues a practice that we described in a September 2007 letter to the Navy in relation to proposed actions at Naval Magazine Indian Island.

NEPA requires that all functionally related activities be considered together, and it mandates "...review of cumulative, incremental impacts of actions when following and/or added to other actions regardless of what agency – federal, nonfederal, private – undertakes such other actions." (40 CFR 1508.7) The Navy's persistent and chronic segmentation of impacts and its lack of cumulative effects analyses are cause for serious and long term concerns about public and environmental health in our own community.

<u>Noise Impacts:</u>

We incorporate our August 16, 2016 Section 106 consultation letter into our general comments. As we mentioned in that letter, the DEIS uses an outdated noise simulation model that a DoD-commissioned study found is not appropriate for Growler engines.

Historic Preservation:

As we stated in our Section 106 consultation letter, we believe that the decision to restrict the APE to areas that immediately surround runways, and to not take into account noise from flight operations beyond that narrow scope, does not accurately measure the effect of those operations on our National Historic Districts.

We appreciate the Navy's extension of the comment period until February 24, 2017. We are aware that many constituent groups have expressed their need for additional time to prepare comments, and believe that granting this extension will result in the Navy having more specific information that they can use to evaluate the comments to the DEIS.

Additionally, while our limited resources constrain our ability to provide you with more detailed suggestions, we commend the detailed analyses and suggestions of our constituent groups, such as the West Coast Action Alliance.

We look forward to the formal Section 106 consultation, as well as seeing your responses to our comments. The City of Port Townsend appreciates the need for military training and is grateful for the sacrifices made by the members of our military and their families.

Sincerely,

[redacted] (b) (6)

Deborah S. Stinson
Mayor

cc: Honorable Patty Murray, U.S. Senator
Honorable Maria Cantwell, U.S. Senator
Honorable Derek Kilmer, U.S. Representative
Honorable Kevin Van de Wege, Washington State Senator
Honorable Steve Tharinger, Washington State Representative
Honorable Mike Chapman, Washington State Representative
Dr. Allyson Brooks, Washington State Historic Preservation Officer
[redacted] (b) (6) Advisory Council on Historic Preservation

City of Port Townsend

Deborah Stinson
Mayor

250 Madison, Suite 2
Port Townsend, WA 98368
360-379-5047
dstinson@cityofpt.us

August 16, 2016

Captain G.C. Moore
Commanding Officer
Naval Air Station, Whidbey Island
3730 North Charles Potter Avenue
Oak Harbor, Washington 98278-5000

RE: Request for Section 106 Comments – EA-18G Growler Operations

Dear Captain Moore:

Thank you for the opportunity you provide in your July 12, 2016 letter for the City of Port Townsend to consult on the proposed Area of Potential Effect ("APE") for the continuation and increase of Growler operations at NAS Whidbey Island.

The City asks that you expand your area of study, as well as your definition of the indirect effects component of the APE. We also ask that you consider using a different measure of sound impacts.

<u>Area of study is too narrow</u>.

Your area of study does not include all of the historic areas over which the Growlers fly. While the primary impact areas on Whidbey are affected by take-off and landing operations, many other areas of the Salish Sea area, including the City, are affected by flight operations. The City was founded in 1851 and contains two U.S. National Historic Landmark Districts: our Downtown and Uptown areas, as well as the Fort Worden Historic District. The Districts include approximately 40 separately-listed properties and structures on the National Register of Historic

Places. The noise impacts from Growler operations impacts residents, visitors, and historic structures in the District. Therefore, the City asks that the APE be expanded to include all historic areas within the training flight areas.

Measure of sound impacts does not take into account rural/naturally quiet areas.

The City believes that the flight operations may diminish the integrity of the setting of Port Townsend's Historic Districts in that they change the historically-quiet setting of those Districts. Also, flight operations may have an adverse physical effect on some historic structures within those Districts[1].

According to your letter, your baseline for impacts is noise over 65 decibel ("dB") Day-Night Average Sound Level ("DNL"). This is an average noise level measured over the course of a year. While this is the FAA standard, FAA policy does not preclude local jurisdictions from setting a lower threshold of compatibility for new land use developments, and the policy allows for supplemental or alternative measurements[2].

The average decibel level in the City, especially at night, is likely to be very low – even below 55dB in certain parts of the City. Growler operations are not continuous; the noise impacts of the operations vary based on the exercise, but include flights over and near the City for hours at a time – frequently at night. Therefore, the City believes that measuring the noise impacts here and on Whidbey using an Effective Perceived Noise Level as provided in Federal Aviation Regulation Part 36 would be a more accurate measure of the effect of flight operations.

Finally, the DNL uses A-weighting for the decibel measurement. It does not take into account low-frequency noise. As noted in a 2004 article:

> Regulatory authorities must accept that annoyance by low frequency noise presents a real problem which is not addressed by the commonly used assessment methods. In particular, the A-weighted level is very inadequate, as are the NR and NC criterion curves. Assessment methods specific to low frequency noise are emerging, but a limitation of existing methods is that they do not give full assessment of fluctuations. It is possible that application of noise quality concepts, in particular fluctuation and roughness (Zwicker and Fastl, 1999), may be a way forward.

---

[1] *See* FAA Section 106 Handbook, June 2015, Page 27, Section C(1)(a), (e); Noise Basics and the Effect of Aviation Noise on the Environment, Wyle, Page 25, Sections 3.10, 3.11 (Viewed at http://www.rduaircraftnoise.com/rduaircraftnoise/noiseinfo/downloads/NoiseBasicsandEffects.pdf on August 16, 2016).

[2] Report No. DOT/FAA/AEE/2011-02, Technical Support for Day/Night Average Sound Level (DNL) Replacement Metric Research, June 14, 2011. Mestre, Schomer, Fidell , & Berry, Authors

Leventhall H G. Low frequency noise and annoyance. Noise Health [serial online] 2004 [cited 2016 Aug 3];6:59-72. Available from: http://www.noiseandhealth.org/text.asp?2004/6/23/59/31663.

The City appreciates the need for pilot training, and is grateful for the sacrifices made by the members of our military and their families. We ask that the APE be expanded to cover all historic areas subject to flight operations, not just take-off and landing. We also ask that you measure those impacts as precisely as possible, and take into consideration low-impact frequencies.

Sincerely,

[redacted]

Deborah S. Stinson
Mayor

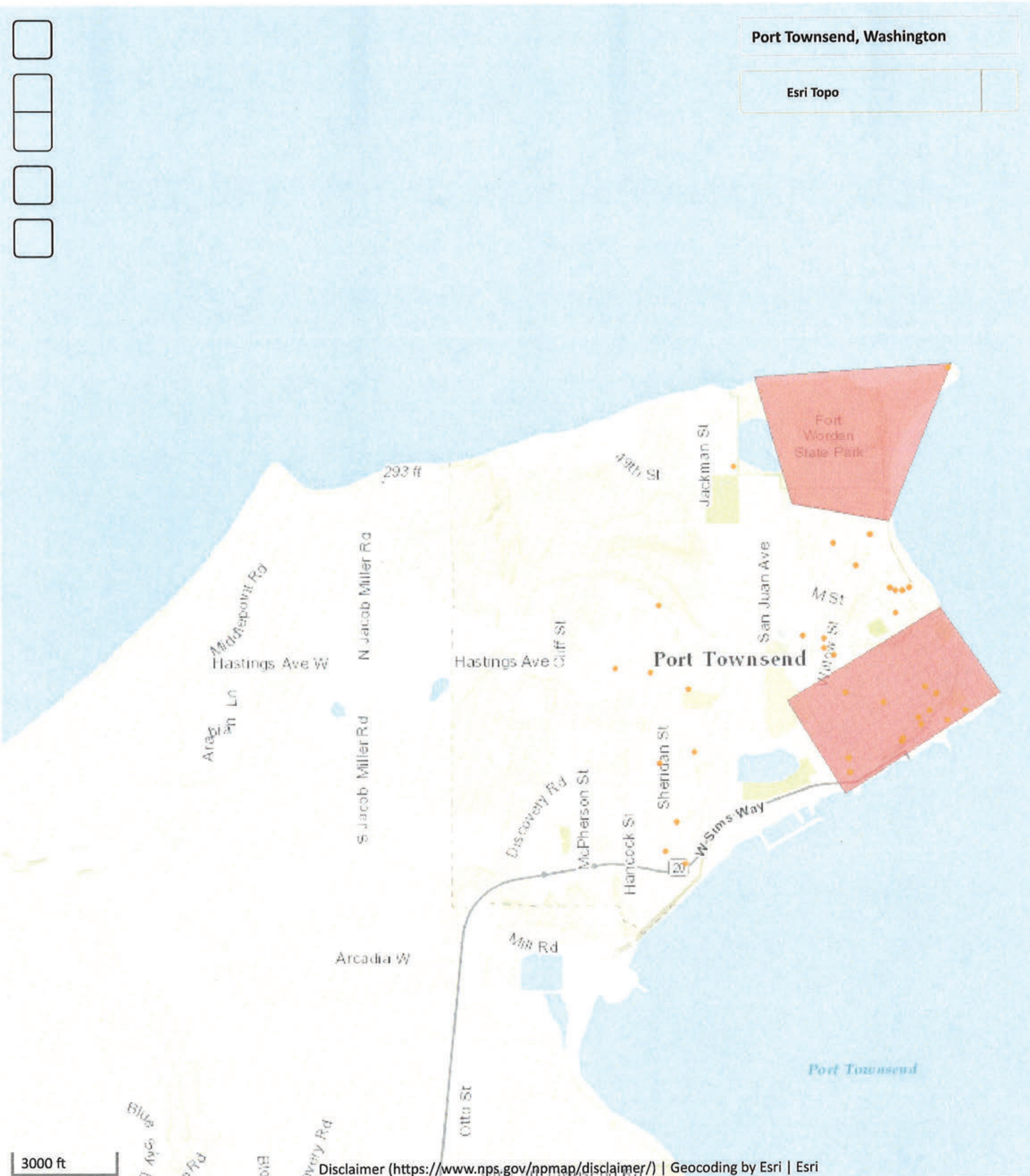
Encl.

cc: Honorable Patty Murray, U.S. Senator
Honorable Maria Cantwell, U.S. Senator
Honorable Derek Kilmer, U.S. Representative
Honorable James Hargrove, Washington State Senator
Honorable Steve Tharinger, Washington State Representative
Honorable Kevin Van De Wege, Washington State Representative

National Register of Histori...

National Park Service
U.S. Department of the Interior

Public, non-restricted data depicting National Register spatial data proce...



Disclaimer (https://www.nps.gov/npmap/disclaimer/) | Geocoding by Esri | Esri

Fall 2020 Monitoring Period Trip Summary:
Naval Air Station Whidbey Island

This report provides a summary of the fall 2020 sound monitoring trip to Naval Air Station Whidbey Island (NASWI). The objectives for this trip were to:

1) Deploy the Sound Level Meters (SLM) at the selected locations around Ault Field and Naval Outlying Field (NOLF) Coupeville,
2) Conduct observations of the flight activity and other sound sources near the SLM sites,
3) Collect real-time operational data, and
4) Demobilize the SLMs at the end of the monitoring period.

Twelve SLMs were deployed by early afternoon of 12 December 2020 and were ready for the start of data collection at 0000 hours on 13 December 2020. During the 13 to 19 December monitoring period, the SLMs continuously recorded sound levels at the selected locations around Ault Field and NOLF Coupville, and personnel from Blue Ridge Research and Consulting, LLC (BRRC) conducted observations near the SLMs throughout this period. Leidos personnel located at Ault Field collected real-time operational data during the same period. On 20 December 2020, the BRRC team retrieved the temporary SLMs to complete the first sound monitoring period.

The team from BRRC traveled to NASWI from 9 to 22 December 2020. The Leidos team traveled to NASWI from 12 to 20 December. Personnel points of contact (POCs) for this visit are identified below.

BRRC Team:	(b) (6) [redacted] (Principal Investigator), (b) (6) [redacted]
Leidos Team:	(b) (6) [redacted]
Primary NASWI POC:	(b) (6) [redacted] (Community Planning and Liaison Officer [CPLO])

Deployment of the SLMs

Twelve SLM sites were selected for the sound monitoring of NASWI flight operations. Five of the sites are around Ault Field (Table 1, Figure 1), six sites are around NOLF Coupeville (Table 2, Figure 2), and one site is within the Olympic National Park. Due to logistic issues (i.e., travel accessibility), semi-permanent SLMs were deployed at the Port Townsend site (Site 33_SG) on 14 October 2020 and the Lopez Island site (Site 5B_SG) on 10 December 2020. An additional twelfth site (40_SG) is located near the Hoh Rainforest Visitor Center area within Olympic National Park to capture sound levels from flight operations within the Olympic MOA. This semi-permanent meter was deployed on 13 October 2020, and it will record sound levels continuously for a minimum of 365 days.

On 12 December 2020, the BRRC team observed that the SLM battery life was less than expected due to the cold weather conditions (dropping as low as 36 degrees Fahrenheit). As a result, the planned SLM maintenance schedule was adjusted to occur each monitoring day in order to replace the batteries on the nine temporary SLMs.

Table 1. SLM Monitoring Sites for Ault Field

Site ID	Name
2B_T	Seaplane Base
3A_T	Skagit River Dike
5B_SG	SE Lopez Island at Pt Colville – Bureau of Land Management (BLM) Land*
8B_SG	North Whidbey Parks & Recreation (on NASWI property)
9B_SG	Corner of Banta Rd & Nortz Rd (on NASWI property)

* Semi-permanent SLM deployed on 10 December 2020

Table 2. SLM Monitoring Sites for NOLF Coupeville

Site ID	Name
20B_SG	Perry House (Admirals Cove Alternative)
24A_B	National Park Service (NPS) Reuble Farm
25B_T	Residence
26B_SG	Reeder Bay Limited Liability Company (LLC) parcel
27A_SG	Town of Coupeville - Water Treatment Plant
33_SG	Port Townsend Historic Downtown District - City Hall*

* Semi-permanent SLM deployed on 14 October 2020

Data Collection and Observations

The BRRC team conducted sample data downloads of each SLM during the first part of the monitoring week to ensure proper functioning of the SLMs. During the daily visits for the replacement of SLM batteries, the BRRC team conducted observations of nearby sound sources at each location. After the first iteration of visits, BRRC personnel determined that the sites were well isolated from loud sound sources that could impact the monitoring assessment. The loudest sources of noise were road traffic (8B_SG, 24A_B, 27A_SG, and 33_SG), vehicular gate crossing (9B_SG), and shotgun blasts (3A_T). The BRRC team conducted over 50 hours of direct and logged observations, with most observations concentrated on the Field Carrier Landing Practice (FCLP) operations at NOLF Coupeville. The BRRC team had no significant interaction with the public during this monitoring period.

Real-Time Operational Data Collection

The NASWI Airfield Manager positioned the Leidos team at the Bird/Animal Aircraft Strike Hazard (BASH) observation building at Ault Field, which provided clear visuals of the airfield operations. The team collected approximately 10 hours of operations between Monday (14 December) and Friday (18 December). Operations were very low on Sunday (13 December) and Saturday (19 December), as expected. During the monitoring period, flight operations were curtailed Monday afternoon because of the low cloud ceiling and high winds. Thus, the scheduled FCLP operations did not occur. FCLP operations were conducted at NOLF Coupeville on Tuesday, Wednesday, and Thursday, with six sessions per day. Runway 14 was used for two of those days, and Runway 32 was used for one day. On Friday, the winds increased again, and FCLP operations were moved to Ault Field. Runway 14 was the runway primarily used at Ault Field for other flight operations, with more limited operations at Runways 07 and 25.

SLM Demobilization

The BRRC team was able to demobilize the temporary SLMs on Sunday without encountering any issues.

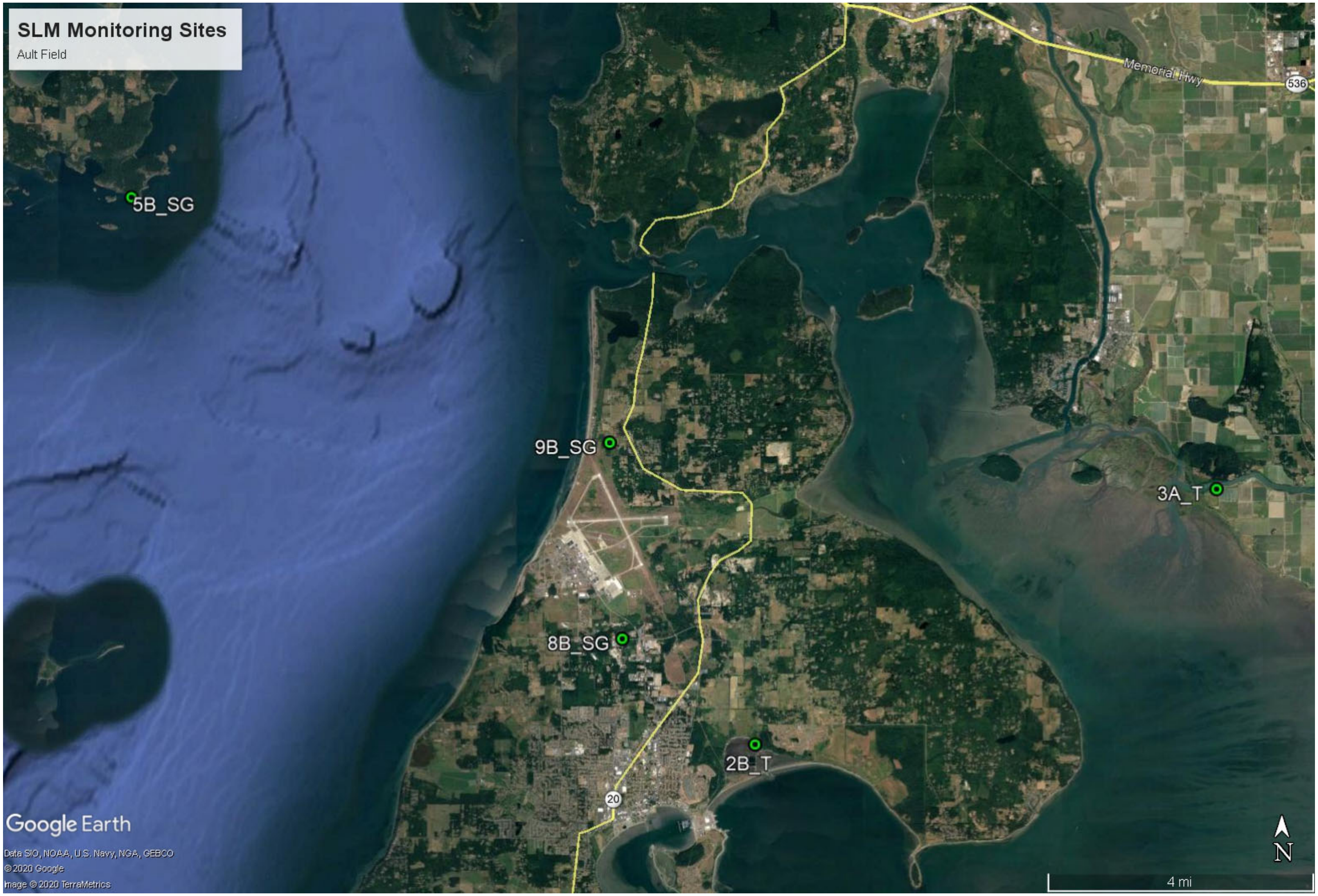


Figure 1. SLM Monitoring Sites for Ault Field

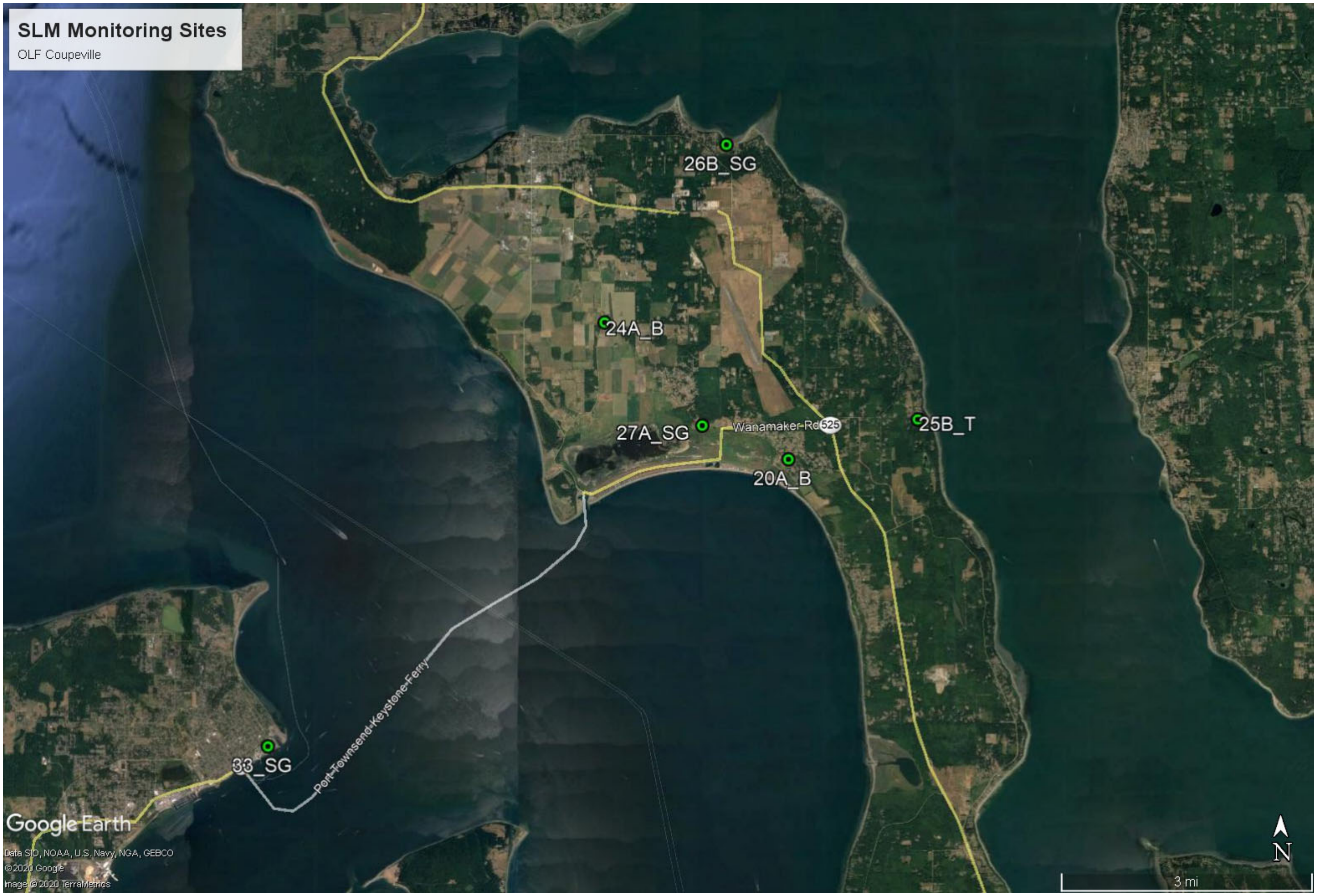


Figure 2. SLM Monitoring Sites for NOLF Coupeville

Monitoring Period 2 Trip Summary:
Naval Air Station Whidbey Island

This report provides a summary of the second sound monitoring trip to Naval Air Station Whidbey Island (NASWI). The objectives for this trip were to:

1) Deploy the Sound Level Meters (SLM) at the selected locations around Ault Field and Naval Outlying Field (NOLF) Coupeville,
2) Conduct observations of the flight activity and other sound sources near the SLM sites,
3) Collect real-time operational data, and
4) Demobilize the SLMs at the end of the monitoring period.

Twelve SLMs were deployed by early afternoon of 26 March 2021 and were ready for the start of data collection at 0000 hours on 28 March 2021. During the 28 March to 3 April monitoring period, the SLMs continuously recorded sound levels at the selected locations around Ault Field and NOLF Coupeville, and personnel from Blue Ridge Research and Consulting, LLC (BRRC) conducted observations near the SLMs throughout this period. Leidos personnel located at Ault Field collected real-time operational data during the same period. On 4 April 2021, the BRRC team retrieved the temporary SLMs to complete the second sound monitoring period.

The team from BRRC traveled to NASWI from 23 March to 4 April 2021. The Leidos team traveled to NASWI from 27 March to 4 April. Personnel points of contact (POCs) for this visit are identified below.

BRRC Team:	(b) (6) [redacted] (Principal Investigator), (b) (6) [redacted]
Leidos Team:	(b) (6) [redacted]
Primary NASWI POC:	(b) (6) [redacted] (Community Planning and Liaison Officer [CPLO])

Deployment of the SLMs

Twelve SLM sites were selected for the sound monitoring of NASWI flight operations. Five of the sites are around Ault Field (Table 1, Figure 1), six sites are around NOLF Coupeville (Table 2, Figure 2), and one site is within the Olympic National Park. Due to logistic issues (i.e., travel accessibility), semi-permanent SLMs were deployed at the Port Townsend site (Site 33_SG) on 14 October 2020 and the Lopez Island site (Site 5B_SG) on 10 December 2020. An additional twelfth site (40_SG) is located near the Hoh Rainforest Visitor Center area within Olympic National Park to capture sound levels from flight operations within the Olympic MOA. This semi-permanent meter was deployed on 13 October 2020, and it will record sound levels continuously for a minimum of 365 days.

For the Period 2 session, BRRC personnel arrived early to deploy and test the usage of lithium batteries paired with solar panels to avoid daily battery changes as well as the disposal of hundreds of D-cell batteries (which had been conducted during observation Period 1). The lithium and solar arrangement was successful and will be utilized in future monitoring periods.

Table 1. SLM Monitoring Sites for Ault Field

Site ID	Name
2B_T	Seaplane Base
3A_T	Skagit River Dike
5B_SG	SE Lopez Island at Pt Colville – Bureau of Land Management (BLM) Land*
8B_SG	North Whidbey Parks & Recreation (on NASWI property)
9B_SG	Corner of Banta Rd & Nortz Rd (on NASWI property)

* Semi-permanent SLM deployed on 10 December 2020

Table 2. SLM Monitoring Sites for NOLF Coupeville

Site ID	Name
20B_SG	Perry House (Admirals Cove Alternative)
24A_B	National Park Service (NPS) Reuble Farm
25B_T	Residence
26B_SG	Reeder Bay Limited Liability Company (LLC) parcel
27A_SG	Town of Coupeville - Water Treatment Plant
33_SG	Port Townsend Historic Downtown District - City Hall*

* Semi-permanent SLM deployed on 14 October 2020

Data Collection and Observations

The BRRC team conducted sample data downloads of each SLM during the first part of the monitoring week to ensure proper functioning of the SLMs. During the semi-daily visits to each SLM to monitor functionality, the BRRC team conducted observations of nearby sound sources at each location. After the first iteration of visits, BRRC personnel determined that the sites were well isolated from new loud sound sources that could impact the monitoring assessment. The loudest sources of noise were road traffic (8B_SG, 24A_B, 27A_SG, and 33_SG), vehicular gate crossing (9B_SG), and passing boats (3A_T). The BRRC team conducted over 38 hours of direct and logged observations, with most observations concentrated on the Field Carrier Landing Practice (FCLP) operations at NOLF Coupeville. The BRRC team had no significant interactions with the public during this monitoring period.

Real-Time Operational Data Collection

The NASWI Airfield Manager positioned the Leidos team at the Bird/Animal Aircraft Strike Hazard (BASH) observation building at Ault Field, which provided clear visuals of the airfield operations. The team collected approximately 10 hours of operations between Monday (29 March) and Friday (2 April). Operations were very low on Sunday (28 March) and Saturday (3 April), as expected. FCLP operations were conducted at NOLF Coupeville on Monday through Thursday, with eight sessions total (four on Monday, one on Tuesday and Wednesday, and two on Thursday). Runway 34 was used for all eight sessions. Runway 25 was the runway primarily used at Ault Field for other flight operations, with more limited operations at Runways 07 and 14, and 32.

SLM Demobilization

The BRRC team was able to demobilize the temporary SLMs on Sunday without encountering any issues.

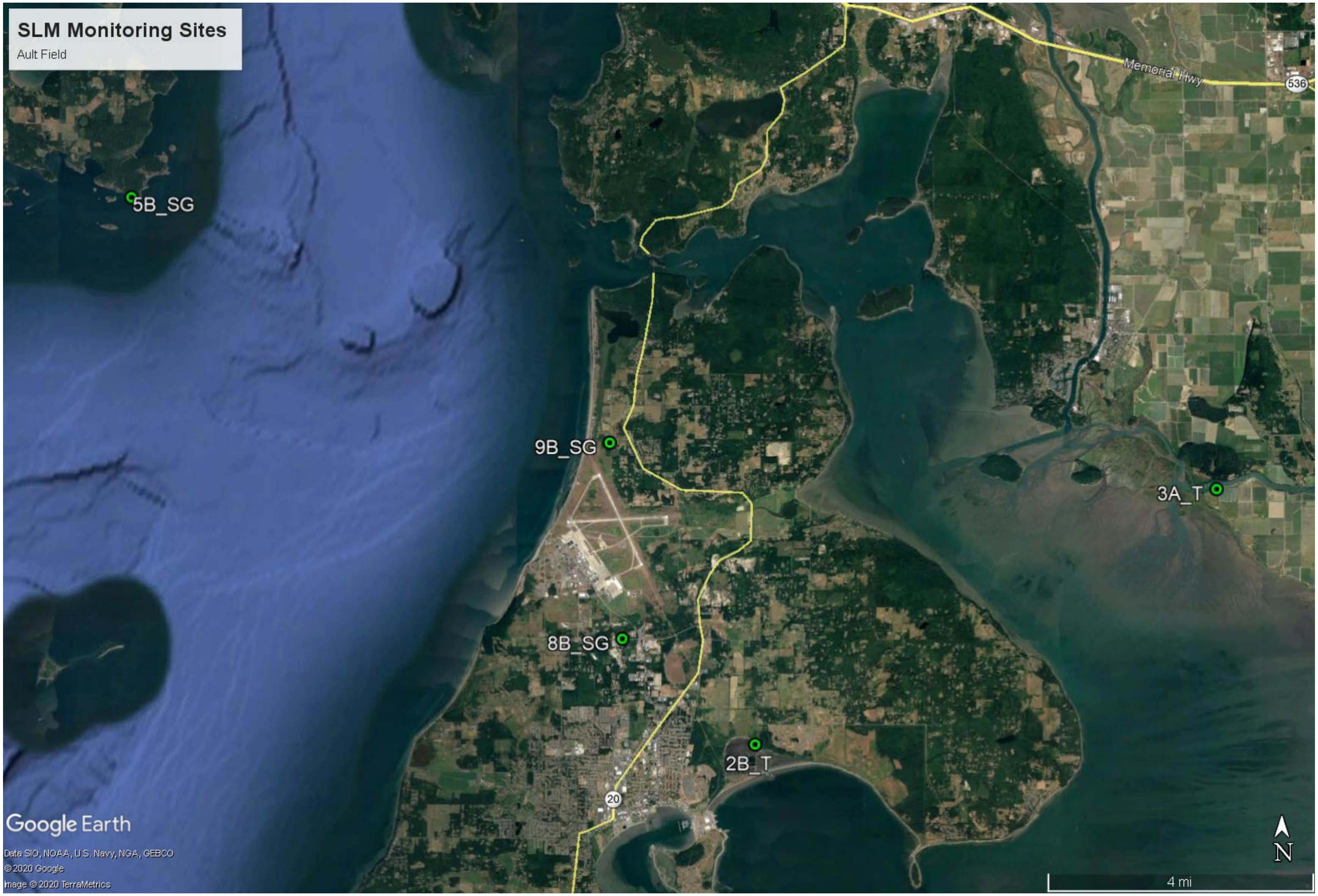


Figure 1. SLM Monitoring Sites for Ault Field

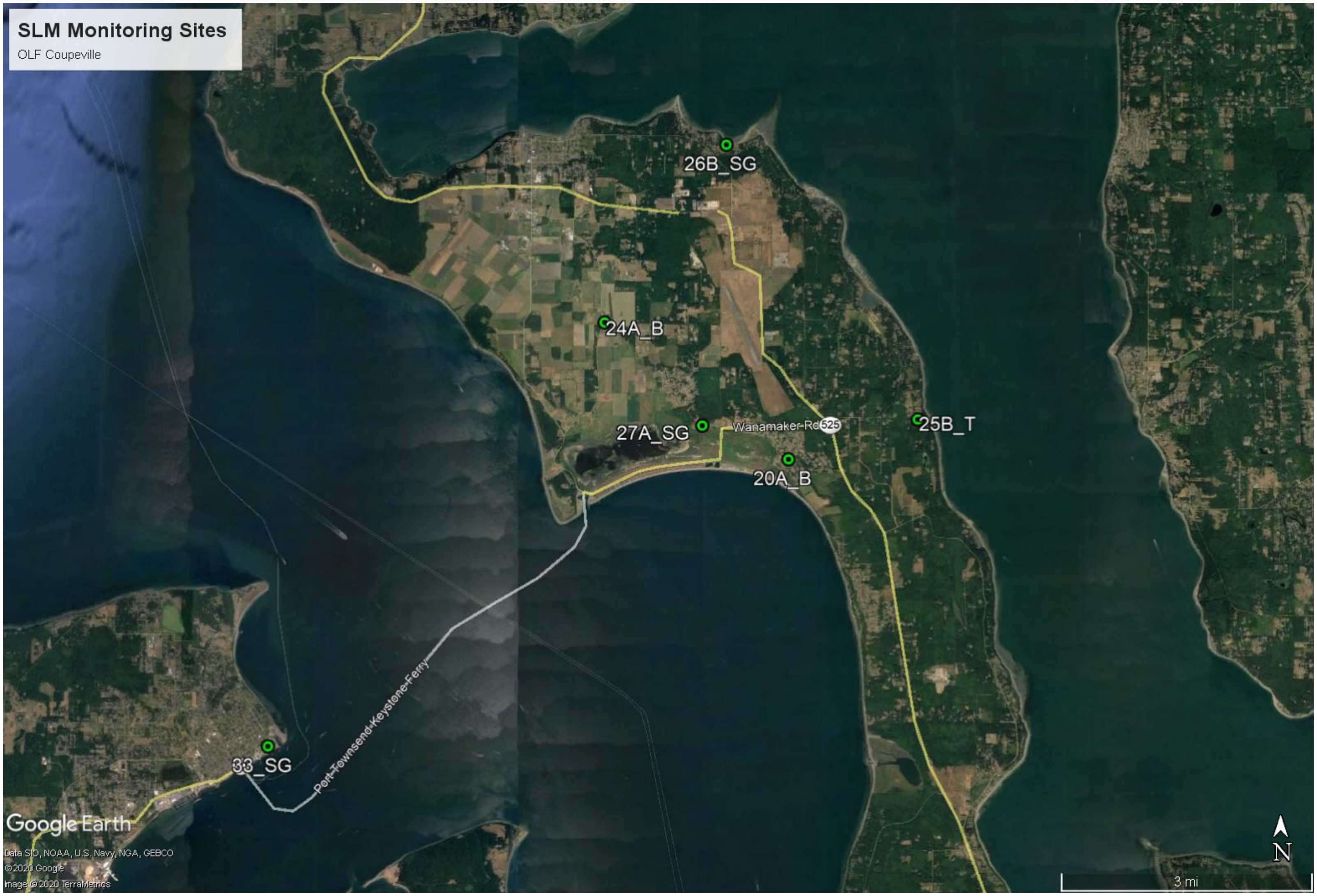


Figure 2. SLM Monitoring Sites for NOLF Coupeville

Monitoring Period 3 Trip Summary:
Naval Air Station Whidbey Island

This report provides a summary of the third sound monitoring trip to Naval Air Station Whidbey Island (NASWI). The objectives for this trip were to:

1) Deploy the Sound Level Meters (SLM) at the selected locations around Ault Field and Naval Outlying Field (NOLF) Coupeville,
2) Conduct observations of the flight activity and other sound sources near the SLM sites,
3) Collect real-time operational data, and
4) Demobilize the SLMs at the end of the monitoring period.

Twelve SLMs were deployed by 5 June 2021 and were ready for the start of data collection at 0000 hours on 6 June 2021. During the 6 to 12 June monitoring period, the SLMs continuously recorded sound levels at the selected locations around Ault Field and NOLF Coupeville, and personnel from Blue Ridge Research and Consulting, LLC (BRRC) conducted observations near the SLMs throughout this period. Leidos personnel located at Ault Field collected real-time operational data during the same period. On 13 June 2021, the BRRC team retrieved the temporary SLMs to complete the third sound monitoring period.

The team from BRRC traveled to NASWI from 3 to 14 June. The Leidos team traveled to NASWI from 5 to 13 June. Personnel points of contact (POCs) for this visit are identified below.

BRRC Team:	(b) (6) [redacted] (Principal Investigator), (b) (6) [redacted]
Leidos Team:	(b) (6) [redacted]
Primary NASWI POC:	(b) (6) [redacted] (Community Planning and Liaison Officer [CPLO])

Deployment of the SLMs

Twelve SLM sites were selected for the sound monitoring of NASWI flight operations. Five of the sites are around Ault Field (Table 1, Figure 1), six sites are around NOLF Coupeville (Table 2, Figure 2), and one site is within the Olympic National Park. Due to logistic issues (i.e., travel accessibility), semi-permanent SLMs were deployed at the Port Townsend site (Site 33_SG) on 14 October 2020 and the Lopez Island site (Site 5B_SG) on 10 December 2020. An additional twelfth site (40_SG) is located near the Hoh Rainforest Visitor Center area within Olympic National Park to capture sound levels from flight operations within the Olympic MOA. This semi-permanent meter was deployed on 13 October 2020, and it will record sound levels continuously for a minimum of 365 days.

For the Period 3 session, BRRC personnel again successfully utilized lithium batteries paired with solar panels to avoid daily battery changes as well as the disposal of hundreds of D-cell batteries. The monitoring equipment was reliably active and maintained throughout the monitoring period.

Table 1. SLM Monitoring Sites for Ault Field

Site ID	Name
2B_T	Seaplane Base
3A_T	Skagit River Dike
5B_SG	SE Lopez Island at Pt Colville – Bureau of Land Management (BLM) Land*
8B_SG	North Whidbey Parks & Recreation (on NASWI property)
9B_SG	Corner of Banta Rd & Nortz Rd (on NASWI property)

* Semi-permanent SLM deployed on 10 December 2020

Table 2. SLM Monitoring Sites for NOLF Coupeville

Site ID	Name
20B_SG	Perry House (Admirals Cove Alternative)
24A_B	National Park Service (NPS) Reuble Farm
25B_T	Residence
26B_SG	Reeder Bay Limited Liability Company (LLC) parcel
27A_SG	Town of Coupeville - Water Treatment Plant
33_SG	Port Townsend Historic Downtown District - City Hall*

* Semi-permanent SLM deployed on 14 October 2020

Data Collection and Observations

The BRRC team conducted sample data downloads of the deployed SLMs prior to the commencement of monitoring to ensure proper setup and data capture. During the semi-daily visits to each SLM to monitor functionality, the BRRC team conducted observations of nearby sound sources at each location. After the first iteration of visits, BRRC personnel determined that the sites were well isolated from new loud sound sources that could impact the monitoring assessment. The loudest sources of noise were road traffic (8B_SG, 24A_B, 27A_SG, and 33_SG), vehicular gate crossing (9B_SG), and passing boats (3A_T). The BRRC team conducted over 33 hours of direct and logged observations, with most observations concentrated on the Field Carrier Landing Practice (FCLP) operations at NOLF Coupeville. The BRRC team had no significant interactions with the public during this monitoring period.

Real-Time Operational Data Collection

The NASWI Airfield Manager positioned the Leidos team at the Bird/Animal Aircraft Strike Hazard (BASH) observation building at Ault Field, which provided clear visuals of the airfield operations. The Leidos team collected approximately 10 hours of operations between Monday (7 June) and Friday (11 June). Operations were very low on Sunday (6 June) and Saturday (12 June), as expected. FCLP operations were conducted on Monday (7 June) through Thursday (10 June). Four sessions of FCLPs occurred at Ault Field from 8:15 PM to 10:30 PM, and ten sessions occurred at NOLF Coupeville from 3:45 PM to 11:30 PM. (Note: the late hours relate to pilot training during dusk and night hours, in which the sunset occurred after 9 PM). Runway 32 was used for all ten sessions at NOLF Coupeville, and Runway 25 was used for the four sessions at Ault Field. Runway 25 was the runway primarily used at Ault Field for other flight operations, with more limited operations at Runways 14, and 32.

SLM Demobilization

The BRRC team was able to demobilize the temporary SLMs on Sunday without encountering any issues.

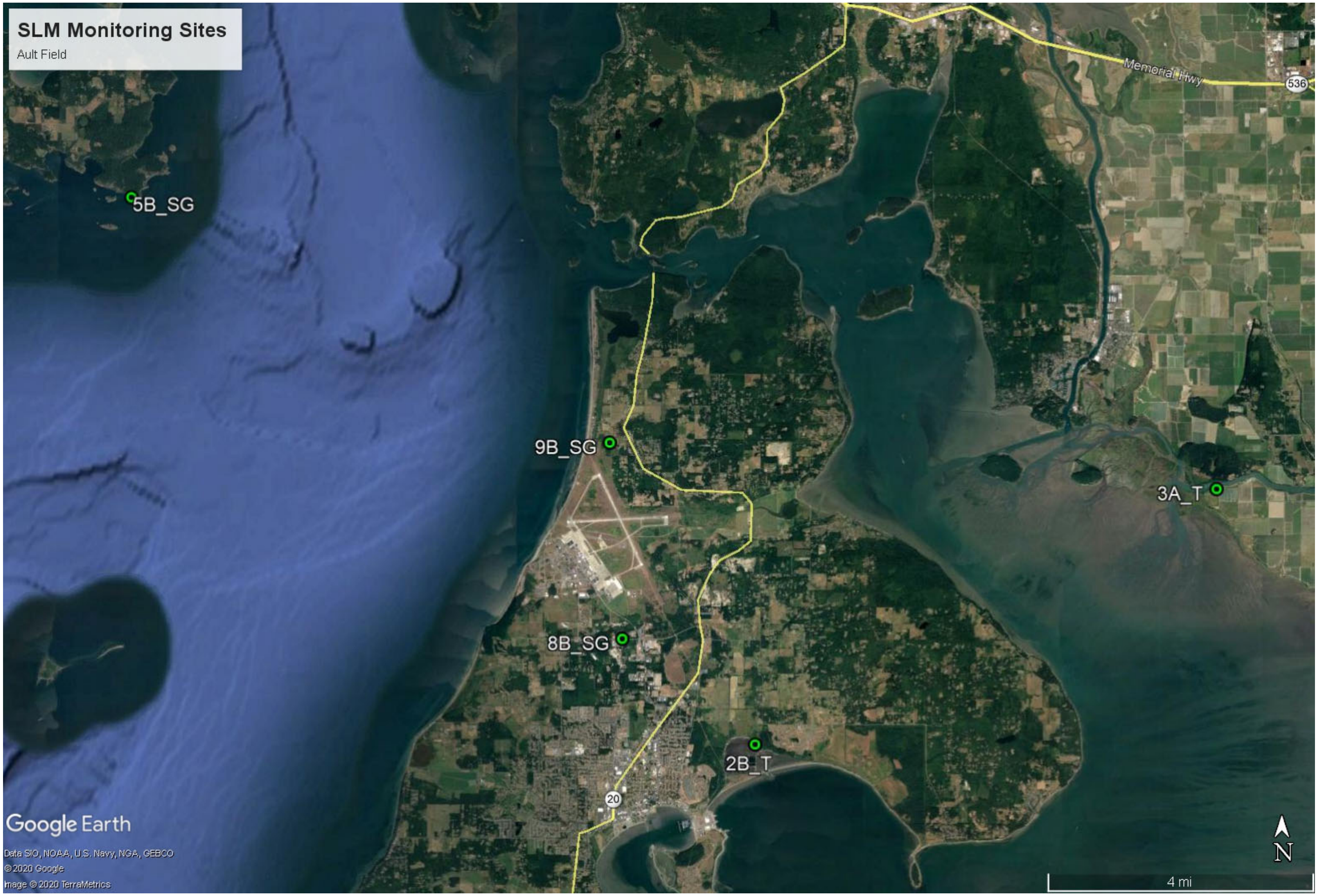


Figure 1. SLM Monitoring Sites for Ault Field

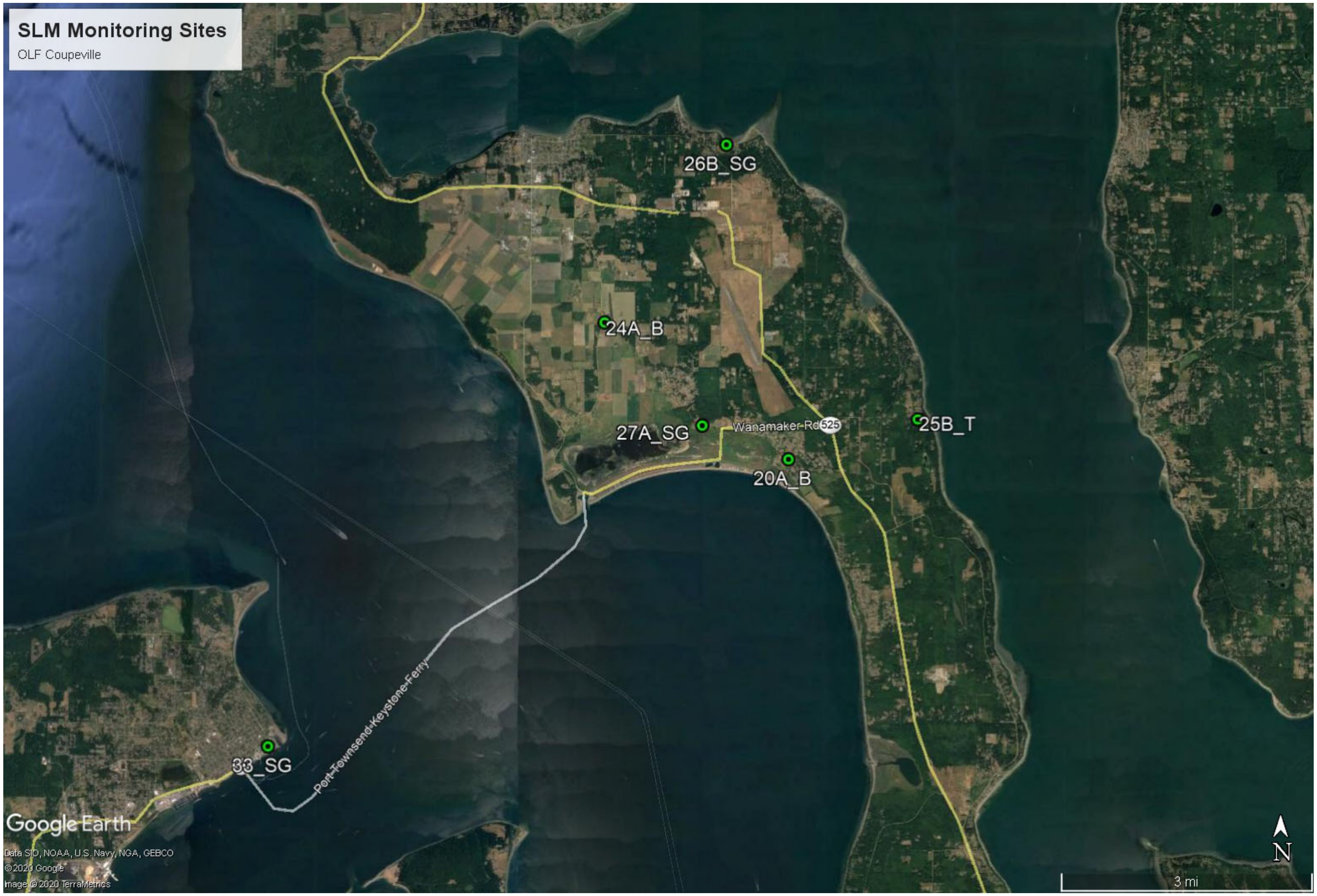


Figure 2. SLM Monitoring Sites for NOLF Coupeville

Monitoring Period 3 Trip Summary:
Naval Air Station Whidbey Island

This report provides a summary of the fourth sound monitoring trip to Naval Air Station Whidbey Island (NASWI). The objectives for this trip were to:

1) Deploy the Sound Level Meters (SLM) at the selected locations around Ault Field and Naval Outlying Field (NOLF) Coupeville,
2) Conduct observations of the flight activity and other sound sources near the SLM sites,
3) Collect real-time operational data, and
4) Demobilize the SLMs at the end of the monitoring period.

Twelve SLMs were deployed by 7 August 2021 and were ready for the start of data collection at 0000 hours on 8 August 2021. During the 8 to 14 August monitoring period, the SLMs continuously recorded sound levels at the selected locations around Ault Field and NOLF Coupeville, and personnel from Blue Ridge Research and Consulting, LLC (BRRC) conducted observations near the SLMs throughout this period. Leidos personnel located at Ault Field collected real-time operational data during the same period. On 15 August 2021, the BRRC team retrieved the temporary SLMs to complete the fourth and final sound monitoring period.

The team from BRRC traveled to NASWI from 5 to 16 August 2021. The Leidos team traveled to NASWI from 7 to 15 August 2021. Personnel points of contact (POCs) for this visit are identified below.

BRRC Team:	(b) (6) [redacted] (Principal Investigator), (b) (6) [redacted]
Leidos Team:	(b) (6) [redacted]
Primary NASWI POC:	(b) (6) [redacted] (Community Planning and Liaison Officer [CPLO])

Deployment of the SLMs

Twelve SLM sites were selected for the sound monitoring of NASWI flight operations. Five of the sites are around Ault Field (Table 1, Figure 1), six sites are around NOLF Coupeville (Table 2, Figure 2), and one site is within the Olympic National Park. Due to logistic issues (i.e., travel accessibility), semi-permanent SLMs were deployed at the Port Townsend site (Site 33_SG) on 14 October 2020 and the Lopez Island site (Site 5B_SG) on 10 December 2020. An additional twelfth site (40_SG) is located near the Hoh Rainforest Visitor Center area within Olympic National Park to capture sound levels from flight operations within the Olympic MOA. This semi-permanent meter was deployed on 13 October 2020, and it will record sound levels continuously for a minimum of 365 days.

For the Period 4 session, BRRC personnel again successfully utilized lithium batteries paired with solar panels to avoid daily battery changes as well as the disposal of hundreds of D-cell batteries. The monitoring equipment was reliably active and maintained throughout the monitoring period.

Table 1. SLM Monitoring Sites for Ault Field

Site ID	Name
2B_T	Seaplane Base
3A_T	Skagit River Dike
5B_SG	SE Lopez Island at Pt Colville – Bureau of Land Management (BLM) Land*
8B_SG	North Whidbey Parks & Recreation (on NASWI property)
9B_SG	Corner of Banta Rd & Nortz Rd (on NASWI property)

* Semi-permanent SLM deployed on 10 December 2020

Table 2. SLM Monitoring Sites for NOLF Coupeville

Site ID	Name
20B_SG	Perry House (Admirals Cove Alternative)
24A_B	National Park Service (NPS) Reuble Farm
25B_T	Residence
26B_SG	Reeder Bay Limited Liability Company (LLC) parcel
27A_SG	Town of Coupeville - Water Treatment Plant
33_SG	Port Townsend Historic Downtown District - City Hall*

* Semi-permanent SLM deployed on 14 October 2020

Data Collection and Observations

The BRRC team conducted sample data downloads of the deployed SLMs prior to the commencement of monitoring to ensure proper setup and data capture. During the semi-daily visits to each SLM to monitor functionality, the BRRC team conducted observations of nearby sound sources at each location. After the first iteration of visits, BRRC personnel determined that the sites were well isolated from new loud sound sources that could impact the monitoring assessment. The loudest sources of noise were road traffic (8B_SG, 24A_B, 27A_SG, and 33_SG), vehicular gate crossing (9B_SG), and passing boats (3A_T). The BRRC team conducted over 30 hours of direct and logged observations, with most observations concentrated on the Field Carrier Landing Practice (FCLP) operations at NOLF Coupeville. The BRRC team had no significant interactions with the public during this monitoring period.

Real-Time Operational Data Collection

The NASWI Airfield Manager positioned the Leidos team at the Bird/Animal Aircraft Strike Hazard (BASH) observation building at Ault Field, which provided clear visuals of the airfield operations. The Leidos team collected approximately 10 hours of operations between Monday (9 August) and Friday (13 August). Operations were very low on Sunday (8 August) and Saturday (14 August), as expected. FCLP operations were conducted on Monday and Tuesday (9 and 10 August) and Thursday (12 August). Seven sessions of FCLPs occurred at NOLF Coupeville from 1:00 PM to 10:50 PM. (Note: the late hours relate to pilot training during dusk and night hours, in which the sunset occurred after 7:30 PM). Runway 32 was used for all seven sessions at NOLF Coupeville, and Runway 25 was used for the two sessions at Ault Field. Runway 25 was the runway primarily used at Ault Field for other flight operations, with more limited operations at Runways 07, 14, and 32.

SLM Demobilization

The BRRC team was able to demobilize the temporary SLMs on Sunday, and Lopez Island and Port Townsend SLMs on Monday, without encountering any issues.

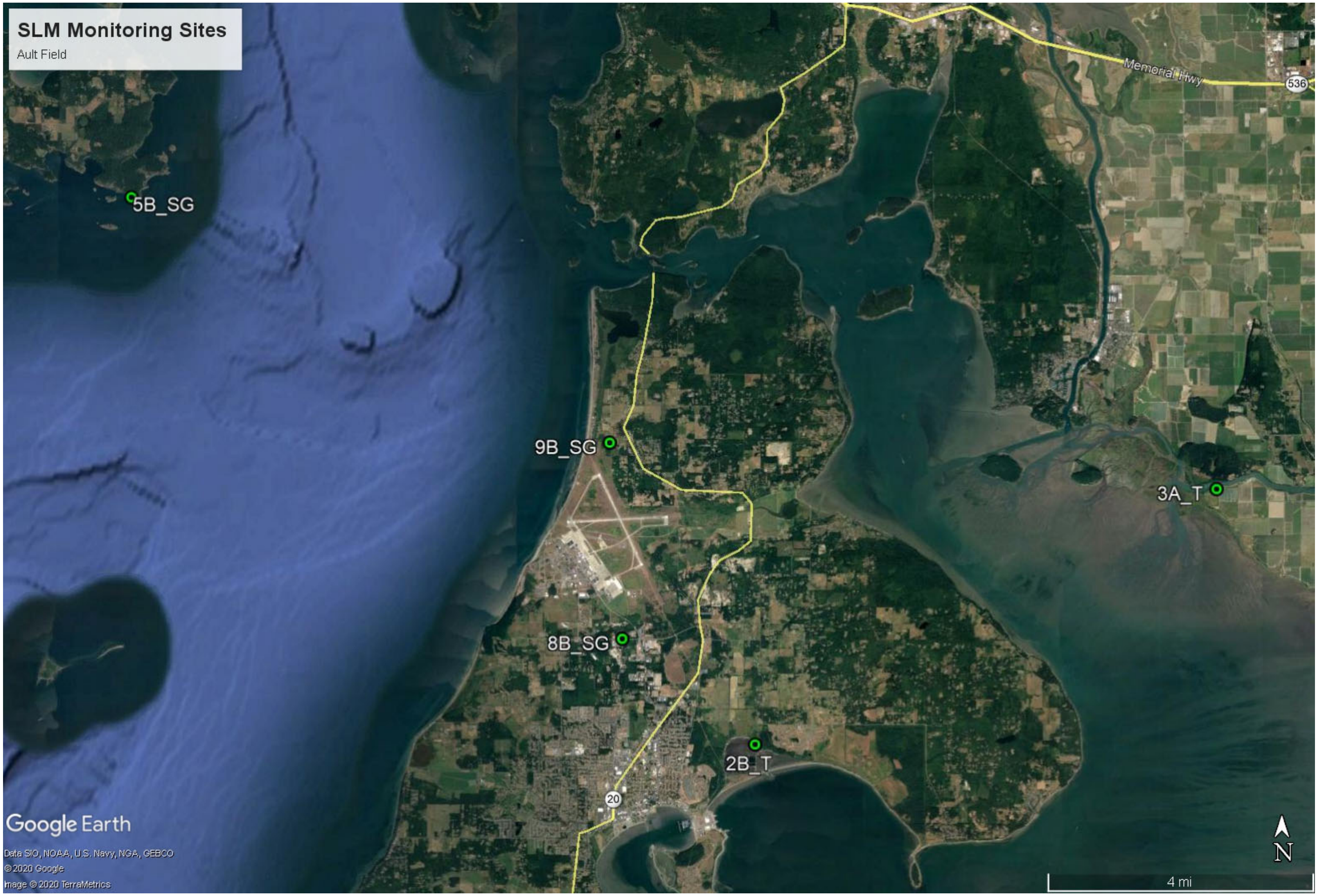


Figure 1. SLM Monitoring Sites for Ault Field

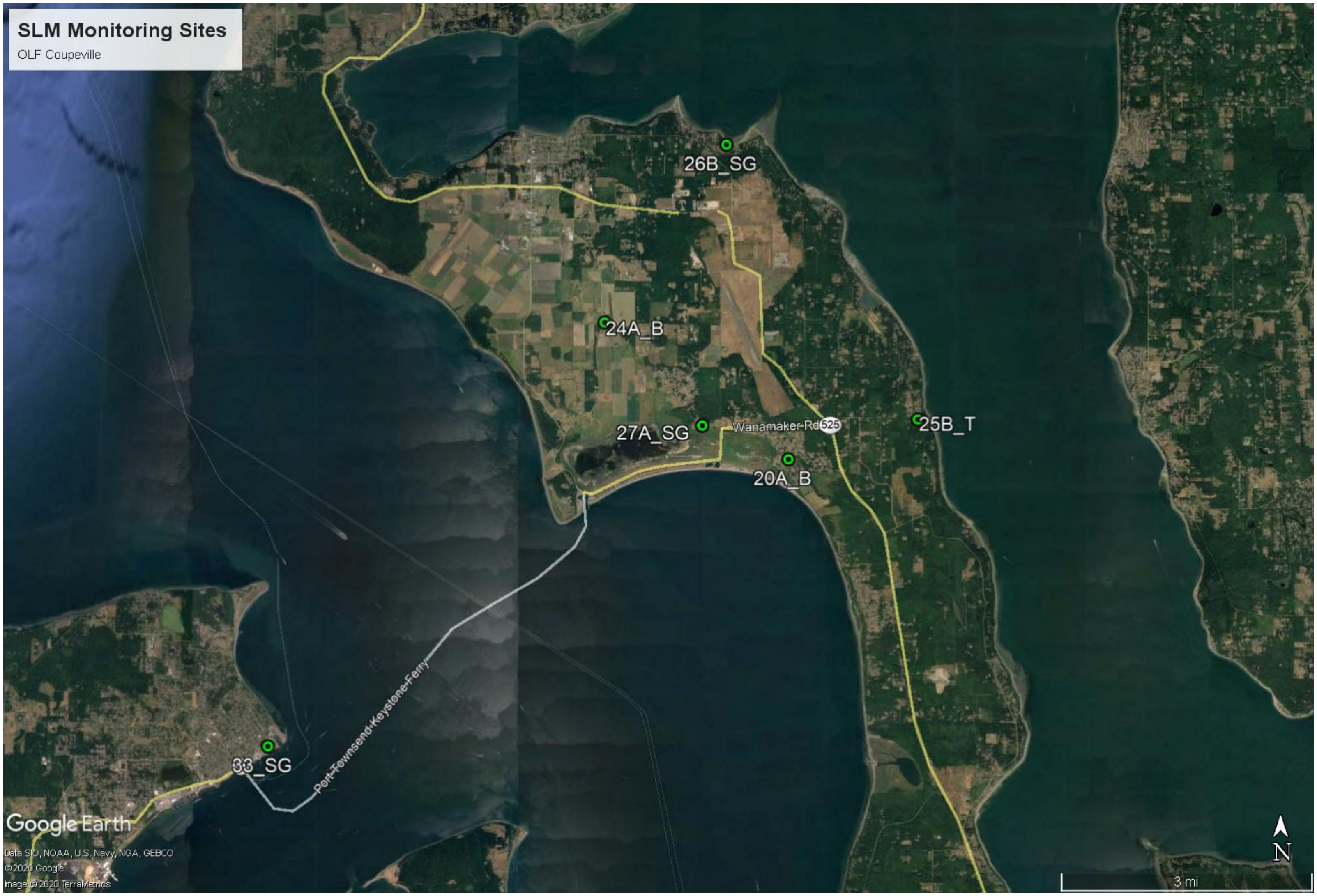


Figure 2. SLM Monitoring Sites for NOLF Coupeville

RIGHT OF ENTRY AGREEMENT

In consideration of the assistance and benefits as described herein, Reeder Bay LLC (herein after referred to as the "OWNER"), located at Reeder Bay Road, Coupeville, WA 98239, hereby grants to the UNITED STATES OF AMERICA, DEPARTMENT OF THE NAVY, its employees, agents, contractors and subcontractors (collectively known as the "GOVERNMENT"), a right of entry upon the premises described below, located in the State of Washington, with the following terms and conditions, effective beginning on November 13, 2020 and ending on December 31, 2021, unless sooner terminated under the terms and conditions herein set forth.

Premises: Island County Parcel S8535-00-0000A-0; and as depicted in the attached Exhibit "A".

Purpose: The OWNER grants to the GOVERNMENT a right to enter the premises to place a sound level meter on the property for four (4) non-contiguous weeks during the term of this Right of Entry Permit. The equipment is temporary in nature and consists of a standard tripod with a microphone attached at approximately 5 feet high and connected to a small battery pack with a solar panel.

Notification: Government will provide at a minimum 24-hour's notice prior to access by contacting the Point of Contact identified below.

Ownership of Tools and Equipment: All tools, equipment, and other property taken upon or placed upon the Premises by the GOVERNMENT shall remain the property of the GOVERNMENT and will be removed by the GOVERNMENT at the end of each of the four (4) non-contiguous weeks of this right of entry.

No Warranty: OWNER grants this right of entry without warranty, either express or implied, regarding to the suitability of the condition of the Premises. The GOVERNMENT shall not hold OWNER liable for any shortage or defect in any part of the Premises or on account of theft of, or damage to, the GOVERNMENT's tools, equipment or other property taken or placed upon the Premises or any physical injury, death or disability of GOVERNMENT employees, trainees, or other personnel associated with the purpose of this Agreement, except where such loss, damage, injury, death, or disability is caused by the fault or negligence of the OWNER.

Liability Limits: The GOVERNMENT agrees to be responsible for damages arising from the activity of the Navy, its officers, employees, authorized representatives (including contractors) on the OWNER's land, under this right of entry, to the extent

authorized by law, including the Federal Tort Claims Act (28 U.S.C. § 2671 et seq.).

The OWNER shall not be responsible for damages to the property or injuries to persons which may arise from or be incident to the GOVERNMENT's use and occupation of such premises pursuant to this right of entry, nor for the damages to the property of or injuries to the GOVERNMENT, or others who may be on the premises at the GOVERNMENT's invitation, except where such damages or injuries are due to the fault or negligence of the OWNER.

The GOVERNMENT shall not be responsible for damages to property or injuries to persons which may arise from or be incident to the use and occupation of the premises by the OWNER, its agents, servants, or employees, or others who may be on the premises at the OWNER's invitation, except where such damages or injuries are due to the fault or negligence of the GOVERNMENT.

Termination: OWNER may terminate this right of entry in the event the GOVERNMENT fails to comply with the terms and conditions of this agreement or in the event of a change of ownership or use of the Premises that OWNER deems inconsistent with continued GOVERNMENT use of the premises. Prior to terminating this right of entry, OWNER shall give the GOVERNMENT no less than thirty (30) days' notice. GOVERNMENT shall have (30) days from receipt of said notice to remedy any failure to comply with the terms and conditions of this right of entry.

Compliance with Laws: All activities performed by the GOVERNMENT on the Premises will be performed in a lawful and prudent manner and in compliance with applicable laws, rules, and regulations, and will not unreasonably interfere with OWNER's normal activities.

No Assignment: The GOVERNMENT may not assign this right of entry or the rights and obligations set forth herein, in whole or in part.

Points of Contact:

OWNER: [redacted]

GOVERNMENT: [redacted]
Realty Specialist
NAVFAC NW
[redacted]@navy.mil
[redacted]

Consideration: OWNER acknowledges as good and valuable consideration the benefits to be derived from this Right of Entry.

Authority: The signatories below represent that they are authorized to execute this Agreement on behalf of the parties.

Entire Agreement: This instrument contains the entire agreement between the parties and supersedes any prior understanding, whether written or verbal.

In Witness hereof, the parties hereto have mutually agreed upon the terms and conditions of this instrument and caused it to be executed as below subscribed:

OWNER

By [redacted]
Owner

Date: 11/17/20

UNITED STATES OF AMERICA

By [redacted]
Real Estate Contracting Officer

Date: 11/17/2020

Exhibit "A"

Parcel S8535-00-0000A-0
Legal Description: a portion within Section 36-Township 32 North, Range 1 East, W.M.
Island County, State of Washington.

MEMORANDUM OF AGREEMENT

BETWEEN

BLUE RIDGE RESEARCH AND CONSULTING, LLC

AND

SKAGIT COUNTY CONSOLIDATED DIKING IMPROVEMENT AND IRRIGATION DISTRICT NO. 22

This Memorandum of Agreement (MOA) is made and entered into as of the date of the last signature affixed below between Blue Ridge Research and Consulting, LLC (hereafter "BRRC") and the Skagit County Consolidated Diking Improvement and Irrigation District No. 22 (hereafter "CDIID22"). This Agreement is adopted to enable operation of a sound level meter and weather monitor on CDIID22 property at the end of Rawlins Road, Mount Vernon, WA 98273 (Exhibit A – Map).

1.0 Purpose

This is a license agreement for the periodic installation and access to a sound level meter and weather monitor on the CDIID22 dike property along the Skagit River at the end of Rawlins Road. BRRC seeks to monitor, evaluate, and analyze noise and noise-related weather in the Western Skagit County area. The monitoring periods will be conducted in four sessions of ten to eleven days each. These periodic sessions will occur approximately once per calendar quarter.

2.0 BRRC Responsibilities:

Purchase, install, and maintain a sound level meter and weather monitor at a location on the dike along the north fork of the Skagit River as seen in the attached map. BRRC will coordinate with the CDIID22 for the installation of the meter. BRRC will locate the meter on the dike so that it is not visible from the road. BRRC will be solely responsible for the meter and will hold the CDIID22 harmless from any damage to the meter caused by people, the elements, or other acts of nature.

BRRC will give the CDIID22 24 hours' notice prior to accessing the meter for installation, maintenance, or removal. The last monitoring session will be completed by 30 November 2021 unless the parties agree to extend this agreement in writing. At the end of each monitoring period, BRRC will remove the meter and restore the location of the meter to as good of condition as prior to the installation.

3.0 CDIID22 Responsibilities:

The CDIID22 will allow BRRC representatives reasonable access to the dike to install, maintain, and monitor the sound level meter. The parties anticipate that BRRC will need to access the meter twelve to twenty times. The CDIID22 may remove the meter if the CDIID22 finds, in its sole discretion, that the meter is damaging the dike or the needs of the CDIID22 require its removal. The CDIID22 will endeavor to give BRRC ten days' written notice prior to removing the meter so that BRRC may relocate it to a mutually agreed upon location.

4.0 Hold Harmless/Indemnification

BRRC uses the CDIID22's property at its own risk, as is, where is, with all faults (if any). BRRC shall defend, indemnify and hold harmless the CDIID22, its officers, officials, employees and volunteers from and against any and all claims, suits, actions, or liabilities for injury or death of any person, or for loss or damage to property, which arises out of the use of the dike or from any activity, work or thing done, permitted, or suffered by BRRC in or about the dike, except only such injury or damage as shall have been occasioned by the sole negligence of the CDIID22.

5.0 Term

The term of this agreement is for two years beginning on the date of the last signature affixed below.

6.0 Contacts

CDIID22 c/o
Skagit Drainage and Irrigation
District Consortium:
[redacted]
2017 Continental Place
Suite 4
Mount Vernon, WA 98273
[redacted]@skagitdidc.org
[redacted]

Blue Ridge Research and Consulting, LLC:
[redacted]
29 N Market St
Suite 700
Asheville, NC 28801
[redacted]@BlueRidgeResearch.com
[redacted]

IN THE WITNESS WHEREOF the parties hereto have caused this agreement to be executed.

CDIID22

By [redacted]
[redacted], Chairman

Date: November 23, 2020

Blue Ridge Research and Consulting, LLC

By [redacted]
[redacted] CFO

Date: ____________________

MEMORANDUM OF AGREEMENT

BETWEEN

BLUE RIDGE RESEARCH AND CONSULTING, LLC

AND

THE TOWN OF COUPEVILLE

This Memorandum of Agreement (MOA) is made and entered into as of the date of the last signature affixed below between the Blue Ridge Research and Consulting, LLC (hereafter "BRRC") and the Town of Coupeville (hereafter "Town"). This Agreement is adopted to enable operation of a sound level meter and weather monitor at the Town of Coupeville Water Treatment Facility located at 434 West Wanamaker Road, Coupeville, WA 98239.

1.0 Purpose

BRRC seeks to monitor, evaluate, and analyze noise and noise-related weather in the Coupeville and Central Whidbey area.

2.0 BRRC Responsibilities:

Purchase, install, and maintain a sound level meter and weather monitor at a mutually agreed upon location at the Water Treatment Facility. BRRC will coordinate with the Town for the installation of the meter. BRRC will locate the meter on the roof of a water tank so that it is not visible from the street and so it will not interfere with the Water Treatment Facility operations. In installing the meter, BRRC will affix it with material that will not require nails, screws, or other items to penetrate the tank. BRRC will be solely responsible for the meter and will hold the Town harmless from any damage to the meter caused by the elements or other acts of nature.

BRRC will install the meter during normal Town working hours (Monday through Friday 8:00 am to 5:00 pm). BRRC will give the Town 24 hours' written notice prior to accessing the meter for installation, maintenance, or removal. BRRC will remove the meter by 30 November 2021 unless the parties agree to extend this agreement in writing. At the end of the metering period, BRRC will remove the meter and restore the location of the meter to as good of condition as prior to the installation.

3.0 Town Responsibilities:

The Town will allow BRRC representatives reasonable access to the Water Treatment Facility during normal business hours to install, maintain, and monitor the sound level meter. The parties anticipate that BRRC will need to access the meter twelve to fifteen times. The Town will provide an agreed upon location for the equipment. The Town may remove the meter if the Town finds, in its sole discretion, that the meter is damaging the tank or the needs of the Town require its removal. The Town will endeavor to give BRRC ten days' written notice prior to removing the meter so that BRRC may relocate it to a mutual agreed upon location.

4.0 Hold Harmless/Indemnification

BRRC shall defend, indemnify and hold harmless the Town, its officers, officials, employees and volunteers from and against any and all claims, suits, actions, or liabilities for injury or death of any person, or for loss or damage to property, which arises out of the use of the Water Treatment Facility or from any activity, work or thing done, permitted, or suffered by BRRC in or about the Water Treatment Facility, except only such injury or damage as shall have been occasioned by the sole negligence of the Town.

5.0 Term

The term of this agreement is for two years beginning on the date of the last signature affixed below.

6.0 Contacts

Town of Coupeville:
Mayor Molly Hughes
Town Hall
P.O. Box 725
Coupeville, WA 98239
Mayor@townofcoupeville.org
360-678-4461 x102

Blue Ridge Research and Consulting, LLC:
[redacted]
29 N Market St
Suite 700
Asheville, NC 28801
[redacted]@BlueRidgeResearch.com
[redacted]

IN THE WITNESS WHEREOF the parties hereto have caused this agreement to be executed.

Town of Coupeville

[redacted]
Molly Hughes, Mayor

Date: 10/14/2020

Blue Ridge Research and Consulting, LLC

By ______________________
[redacted] CFO

Date: ______________________

PROGRESS REPORT #18
Aircraft Sound Monitoring Study

Contract:	N62470-19-D-4009, Task Order N6247020F4047
Period of Performance:	13 April 2020 through 31 January 2022
Prepared for:	[redacted], NAVFAC Atlantic
Prepared by:	[redacted] (Leidos) and [redacted] (BRRC)
Dates Covered:	September 2021

1. Summary of Work Accomplished During this Period

Task 1 – Kickoff, Work Plan, Schedule

- Task completed (*project schedule/milestone progress will continue to be updated under Task 6 project management activities*).

Task 2 – Monitoring Plan

- Task completed.

Task 3 – Pre-Data Collection/Logistics Site Visit

- Task completed (*refinement of operation data collection tool will continue, as needed, under Task 4 data collection activities*).

Task 4 – Data Collection

- Submitted the trip reports on 13 September 2021 for the fourth monitoring periods at NAS Lemoore (August 22–28) and NAS Whidbey Island (August 8–14).

Task 5 – Analysis and Reporting of Data

- Continued data organization and analysis of noise data from NAS Whidbey Island, NAS Lemoore, and the Olympic MOA.
- Continued coordinating with the *Report to Congress Working Group*, including helping develop a POAM and preparing various versions of the draft report.

Task 6 – Miscellaneous Deliverables/Meetings

- Attended *Report to Congress Working Group* calls on 2, 10, 16, 23, 24, and 30 September 2021.

Status of Contract Elements

Element	*Activity*	*Previous % Complete*	*Change in % Complete*	*Current % Completed*
Task 1	Kickoff, Work Plan, Schedule	100	-	100
Task 2	Monitoring Plan	100	-	100

Element	*Activity*	*Previous % Complete*	*Change in % Complete*	*Current % Completed*
Task 3	Pre-Data Collection/Logistics Site Visit	100	-	100
Task 4	Data Collection	90	5	95
Task 5	Analysis and Reporting of Data	55	5	60
Task 6	Miscellaneous Deliverables	87	2	89

3. Summary of Issues/Concerns

- (b) (5) [redacted]

4. Summary of Items Needed from the Government

- Operational data for flights within Olympic MOA (coordination with NASWI is established).

5. Summary of Work to be Accomplished Next Period

- Continue analysis of noise data from NAS Whidbey Island, NAS Lemoore, and Olympic MOA.

6. Project Schedule

MILESTONE SCHEDULE FOR DELIVERABLES		
TASK	**RELATED TASK**	**DELIVERABLE DATE**
Kick-Off Meeting	1. Pre-kickoff Meeting 2. Submit Meeting Notes 3. Kickoff Meeting 4. Submit Meeting Notes	1. 22 April 2020 (√) 2. 22 April 2020 (√) 3. 6 May 2020 (√) 4. 8 May 2020 (√)
Sound Monitoring Study	1. Work Plan 2. Initial Data Collection 3. Detailed Monitoring Plan 4. NASWI Logistics Visit 5. NASL Logistics Visit 6. NASWI Site Visit #1 7. NASL Site Visit #1 8. Interim Briefing #1 9. NASWI Site Visit #2 10. NASL Site Visit #2 11. NASWI Site Visit #3 12. NASL Site Visit #3 13. Interim Briefing #2 14. NASWI Site Visit #4 15. NASL Site Visit #4 16. Pre-Final Technical Report 17. Government Review 18. Final Technical Report 19. Raw Data for Public Release	1. 20 May 2020 (√) 2. May - August 2020 (√) 3. August 2020 (√) 4. August 2020 (√) 5. October 2020 (√) 6. December 2020 (√) 7. January 2021 (√) 8. 18 March 2021 (√) 9. 28 March – 3 April 2021 (√) 10. 11 – 17 April 2021 (√) 11. 6 – 12 June 2021 (√) 12. 16 – 22 May 2021 (√) 13. August 2021 (√) 14. 8 – 14 August 2021 (√) 15. 22 – 28 August 2021 (√) 16. 21 December 2021 (*tentative*) 17. 11 January 2022 (*tentative*) 18. 25 January 2022 (*tentative*) 19. By 31 January 2022
Monthly Progress Reports	Leidos submits to NAVFAC	Due by 10th of the month

PROGRESS REPORT #19
Aircraft Sound Monitoring Study

Contract:	N62470-19-D-4009, Task Order N6247020F4047
Period of Performance:	13 April 2020 through 31 January 2022
Prepared for:	[redacted], NAVFAC Atlantic
Prepared by:	[redacted] (Leidos) and [redacted] (BRRC)
Dates Covered:	October 2021

1. Summary of Work Accomplished During this Period

Task 1 – Kickoff, Work Plan, Schedule

- Task completed (*project schedule/milestone progress will continue to be updated under Task 6 project management activities*).

Task 2 – Monitoring Plan

- Task completed.

Task 3 – Pre-Data Collection/Logistics Site Visit

- Task completed.

Task 4 – Data Collection

- Completed data collection with the Olympic MOA sound level meter on 20 October 2021.

Task 5 – Analysis and Reporting of Data

- Continued data organization and analysis of noise data from NAS Whidbey Island, NAS Lemoore, and the Olympic MOA.
- Continued coordinating with the *Report to Congress Working Group*, including helping update a POAM and preparing various versions of the draft report (including formatting and technical editing).

Task 6 – Miscellaneous Deliverables/Meetings

- Updated the project schedule on 20 October 2021.
- Attended *Report to Congress Working Gr*oup calls on multiple days in October 2021.

Status of Contract Elements

Element	*Activity*	*Previous % Complete*	*Change in % Complete*	*Current % Completed*
Task 1	Kickoff, Work Plan, Schedule	100	-	100
Task 2	Monitoring Plan	100	-	100
Task 3	Pre-Data Collection/Logistics Site Visit	100	-	100
Task 4	Data Collection	95	5	100
Task 5	Analysis and Reporting of Data	60	10	70
Task 6	Miscellaneous Deliverables	89	2	91

3. **Summary of Issues/Concerns**
   - (b) (5) [redacted]

4. **Summary of Items Needed from the Government**
   - None at this time.

5. **Summary of Work to be Accomplished Next Period**
   - Continue analysis of noise data from NAS Whidbey Island, NAS Lemoore, and Olympic MOA.
   - Submit the draft Executive Summary of the technical report in early November.

6. Project Schedule

MILESTONE SCHEDULE FOR DELIVERABLES		
TASK	**RELATED TASK**	**DELIVERABLE DATE**
Kick-Off Meeting	1. Pre-kickoff Meeting 2. Submit Meeting Notes 3. Kickoff Meeting 4. Submit Meeting Notes	1. 22 April 2020 (√) 2. 22 April 2020 (√) 3. 6 May 2020 (√) 4. 8 May 2020 (√)
Sound Monitoring Study	1. Work Plan 2. Initial Data Collection 3. Detailed Monitoring Plan 4. NASWI Logistics Visit 5. NASL Logistics Visit 6. NASWI Site Visit #1 7. NASL Site Visit #1 8. Interim Briefing #1 9. NASWI Site Visit #2 10. NASL Site Visit #2 11. NASWI Site Visit #3 12. NASL Site Visit #3 13. Interim Briefing #2 14. NASWI Site Visit #4 15. NASL Site Visit #4 16. Executive Summary 17. Draft Technical Report 18. Government Review 19. Pre-Final Technical Report 20. Government Review 21. Final Technical Report 22. Government Approval	1. 20 May 2020 (√) 2. May - August 2020 (√) 3. August 2020 (√) 4. August 2020 (√) 5. October 2020 (√) 6. December 2020 (√) 7. January 2021 (√) 8. 18 March 2021 (√) 9. 28 March – 3 April 2021 (√) 10. 11 – 17 April 2021 (√) 11. 6 – 12 June 2021 (√) 12. 16 – 22 May 2021 (√) 13. August 2021 (√) 14. 8 – 14 August 2021 (√) 15. 22 – 28 August 2021 (√) 16. 4 November 2021 (√) 17. 10 December 2021 18. 24 December 2021 19. 7 January 2022 20. 21 January 2022 21. 28 January 2022 22. 31 January 2022
Monthly Progress Reports	Leidos submits to NAVFAC	Due by 10th of the month

PROGRESS REPORT #20
Aircraft Sound Monitoring Study

Contract:	N62470-19-D-4009, Task Order N6247020F4047
Period of Performance:	13 April 2020 through 31 January 2022
Prepared for:	[redacted], NAVFAC Atlantic
Prepared by:	[redacted] (Leidos) and [redacted] (BRRC)
Dates Covered:	November 2021

1. Summary of Work Accomplished During this Period

Task 1 – Kickoff, Work Plan, Schedule

- Task completed (*project schedule/milestone progress will continue to be updated under Task 6 project management activities*).

Task 2 – Monitoring Plan

- Task completed.

Task 3 – Pre-Data Collection/Logistics Site Visit

- Task completed.

Task 4 – Data Collection

- Task completed.

Task 5 – Analysis and Reporting of Data

- Continued data organization and analysis of noise data from NAS Whidbey Island, NAS Lemoore, and the Olympic MOA.
- Continued preparation of the Technical Report.
- Discussed the development of the public database.
- Completed coordination with the *Report to Congress Working Group*, including final edits.

Task 6 – Miscellaneous Deliverables/Meetings

- Updated the project schedule on 20 October 2021.
- Attended *Report to Congress Working G*roup calls on multiple days in November 2021.

Status of Contract Elements

Element	*Activity*	*Previous % Complete*	*Change in % Complete*	*Current % Completed*
Task 1	Kickoff, Work Plan, Schedule	100	-	100
Task 2	Monitoring Plan	100	-	100

Element	*Activity*	*Previous % Complete*	*Change in % Complete*	*Current % Completed*
Task 3	Pre-Data Collection/Logistics Site Visit	100	-	100
Task 4	Data Collection	100	-	100
Task 5	Analysis and Reporting of Data	70	10	80
Task 6	Miscellaneous Deliverables	91	2	93

3. Summary of Issues/Concerns

- (b) (5) [redacted]

4. Summary of Items Needed from the Government

- None at this time.

5. Summary of Work to be Accomplished Next Period

- Continue analysis of noise data from NAS Whidbey Island, NAS Lemoore, and Olympic MOA.
- Submit the draft technical report.

6. Project Schedule

MILESTONE SCHEDULE FOR DELIVERABLES		
TASK	**RELATED TASK**	**DELIVERABLE DATE**
Kick-Off Meeting	1. Pre-kickoff Meeting 2. Submit Meeting Notes 3. Kickoff Meeting 4. Submit Meeting Notes	1. 22 April 2020 (√) 2. 22 April 2020 (√) 3. 6 May 2020 (√) 4. 8 May 2020 (√)
Sound Monitoring Study	1. Work Plan 2. Initial Data Collection 3. Detailed Monitoring Plan 4. NASWI Logistics Visit 5. NASL Logistics Visit 6. NASWI Site Visit #1 7. NASL Site Visit #1 8. Interim Briefing #1 9. NASWI Site Visit #2 10. NASL Site Visit #2 11. NASWI Site Visit #3 12. NASL Site Visit #3 13. Interim Briefing #2 14. NASWI Site Visit #4 15. NASL Site Visit #4 16. Executive Summary 17. Draft Technical Report 18. Government Review 19. Pre-Final Technical Report 20. Government Review 21. Final Technical Report 22. Government Approval	1. 20 May 2020 (√) 2. May - August 2020 (√) 3. August 2020 (√) 4. August 2020 (√) 5. October 2020 (√) 6. December 2020 (√) 7. January 2021 (√) 8. 18 March 2021 (√) 9. 28 March – 3 April 2021 (√) 10. 11 – 17 April 2021 (√) 11. 6 – 12 June 2021 (√) 12. 16 – 22 May 2021 (√) 13. August 2021 (√) 14. 8 – 14 August 2021 (√) 15. 22 – 28 August 2021 (√) 16. 4 November 2021 (√) 17. 10 December 2021 18. 24 December 2021 19. 7 January 2022 20. 21 January 2022 21. 28 January 2022 22. 31 January 2022
Monthly Progress Reports	Leidos submits to NAVFAC	Due by 10th of the month

PROGRESS REPORT #21
Aircraft Sound Monitoring Study

Contract:	N62470-19-D-4009, Task Order N6247020F4047
Period of Performance:	13 April 2020 through 31 January 2022
Prepared for:	[redacted], NAVFAC Atlantic
Prepared by:	[redacted] (Leidos) and [redacted] (BRRC)
Dates Covered:	December 2021

1. Summary of Work Accomplished During this Period

Task 1 – Kickoff, Work Plan, Schedule

- Task completed (*project schedule/milestone progress will continue to be updated under Task 6 project management activities*).

Task 2 – Monitoring Plan

- Task completed.

Task 3 – Pre-Data Collection/Logistics Site Visit

- Task completed.

Task 4 – Data Collection

- Task completed.

Task 5 – Analysis and Reporting of Data

- Continued data organization and analysis of noise data from NAS Whidbey Island, NAS Lemoore, and the Olympic MOA.
- Submitted Draft Technical Report on 12 December 2021.
- Government comments on Draft Technical Report submitted between 16 – 24 December 2021; coordinated with government on addressing comments.
- Uploaded all sound level meter data files to the Navy.

Task 6 – Miscellaneous Deliverables/Meetings

- Continued coordination with NAVFAC.

Status of Contract Elements

Element	*Activity*	*Previous % Complete*	*Change in % Complete*	*Current % Completed*
Task 1	Kickoff, Work Plan, Schedule	100	-	100
Task 2	Monitoring Plan	100	-	100
Task 3	Pre-Data Collection/Logistics Site Visit	100	-	100
Task 4	Data Collection	100	-	100
Task 5	Analysis and Reporting of Data	80	5	85
Task 6	Miscellaneous Deliverables	93	3	96

3. Summary of Issues/Concerns

- (b) (5) [redacted]

4. Summary of Items Needed from the Government

- None at this time.

5. Summary of Work to be Accomplished Next Period

- Address government comments, and submit Pre-Final Technical Report.
- Submit Final Technical Report.
- Upload all data items for public website.

6. Project Schedule

MILESTONE SCHEDULE FOR DELIVERABLES		
TASK	**RELATED TASK**	**DELIVERABLE DATE**
Kick-Off Meeting	1. Pre-kickoff Meeting 2. Submit Meeting Notes 3. Kickoff Meeting 4. Submit Meeting Notes	1. 22 April 2020 (√) 2. 22 April 2020 (√) 3. 6 May 2020 (√) 4. 8 May 2020 (√)
Sound Monitoring Study	1. Work Plan 2. Initial Data Collection 3. Detailed Monitoring Plan 4. NASWI Logistics Visit 5. NASL Logistics Visit 6. NASWI Site Visit #1 7. NASL Site Visit #1 8. Interim Briefing #1 9. NASWI Site Visit #2 10. NASL Site Visit #2 11. NASWI Site Visit #3 12. NASL Site Visit #3 13. Interim Briefing #2 14. NASWI Site Visit #4 15. NASL Site Visit #4 16. Executive Summary 17. Draft Technical Report 18. Government Review 19. Pre-Final Technical Report 20. Government Review 21. Final Technical Report 22. Government Approval	1. 20 May 2020 (√) 2. May - August 2020 (√) 3. August 2020 (√) 4. August 2020 (√) 5. October 2020 (√) 6. December 2020 (√) 7. January 2021 (√) 8. 18 March 2021 (√) 9. 28 March – 3 April 2021 (√) 10. 11 – 17 April 2021 (√) 11. 6 – 12 June 2021 (√) 12. 16 – 22 May 2021 (√) 13. August 2021 (√) 14. 8 – 14 August 2021 (√) 15. 22 – 28 August 2021 (√) 16. 4 November 2021 (√) 17. 10 December 2021 (√) 18. 24 December 2021 (√) 19. 7 January 2022 20. 21 January 2022 21. 28 January 2022 22. 31 January 2022
Monthly Progress Reports	Leidos submits to NAVFAC	Due by 10th of the month

Blue Ridge Research and Consulting, LLC

Technical Report 22-01

Navy Real-Time Aircraft Sound Monitoring Study: Technical Report

28 January 2022

Prepared for:
United States Department of the Navy

Blue Ridge Research and Consulting, LLC
29 N Market St, Suite 700
Asheville, NC 28801
828.252.2209
BlueRidgeResearch.com

Prepared by:
(b) (6) [redacted], Ph.D.
(b) (6) [redacted], M.S.
(b) (6) [redacted], M.S.
(b) (6) [redacted], M.S.
(b) (6) [redacted], M.S.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

>	Greater Than
<	Less Than
ANSI/ASA	American National Standards Institute/Acoustical Society of America
ARP	Aerospace Recommended Practice
ATC	Air Traffic Control
CNEL	Community Noise Equivalent Level
COVID-19	Coronavirus Disease 2019
dB	Decibels
dBA	A-weighted Decibels
DNL	Day-Night Average Sound Level
DoD	Department of Defense
EIS	Environmental Impact Statement
F-35C West Coast Homebasing EIS	*Environmental Impact Statement for U.S. Navy F-35C West Coast Homebasing*
FCLP	Field Carrier Landing Practice
FRS	Fleet Replacement Squadron
FY	Fiscal Year
GCA	Ground Controlled Approach
Growler EIS	*Environmental Impact Statement for EA-18G "Growler" Airfield Operations at Naval Air Station Whidbey Island Complex*
HVAC	Heating, Ventilation, and Air Conditioning
Hz	Hertz
IFR	Instrument Flight Rules
ISO	International Organization for Standardization
L_{Aeq}	A-weighted Equivalent Continuous Sound Level
L_{Amax}	A-weighted Maximum Sound Level
L_{dnmr}	Onset Rate-adjusted Monthly Day-Night Average Sound Level
MOA	Military Operations Area
MRNMAP	Military Operations Area and Range NOISEMAP
MTR	Military Training Routes
NAS	Naval Air Station
Navy	United States Department of the Navy
NDAA	National Defense Authorization Act
Northwest Training and Testing SEIS/OEIS	*Northwest Training and Testing Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement*
NPS	National Park Service
OLF	Outlying Landing Field
SEL	Sound Exposure Level
VFR	Visual Flight Rules

KEY TERMS USED IN THIS STUDY

- ***real-time acoustic data*** – acoustic data collected by the sound level meters during the monitoring periods
- ***real-time flight operations data*** – flight operations data collected from local Air Traffic Control logs and separate visual field observations by the monitoring team during the monitoring periods
- ***real-time measured data*** – ***real-time acoustic data*** merged with ***real-time operations data***
- ***real-time modeled results*** – the NOISEMAP modeling results based on input from ***real-time flight operations data*** collected as part of this study
- ***previously modeled results*** – the NOISEMAP modeling results from prior impact assessments

1 INTRODUCTION

In compliance with Section 325 of the National Defense Authorization Act (NDAA) for Fiscal Year (FY) 2020, the United States Department of the Navy (Navy) submitted a report to Congress on 01 December 2021 on the results of real-time aircraft sound monitoring. This technical report (22-01) provides more detailed information that supports findings in the report to Congress and describes the publicly available set of monitoring data collected by the Navy.

The remainder of Section 1 summarizes the project. Section 2 details the design of the monitoring study to comply with the NDAA. Sections 3 and 4 describe the data collection and analysis procedures, respectively. Section 5 compares the monitored results with modeled results, and Section 6 summarizes the conclusions based on results of the study. Additionally, this report includes several appendices to provide more information on the basics of sound, the Department of Defense (DoD) aircraft noise models, and the DoD noise study process.

1.1 Purpose

The FY 2020 NDAA required the Navy to select, "…no fewer than two Navy installations and their outlying fields on the west coast," for real-time sound monitoring. The Navy selected Naval Air Station (NAS) Whidbey Island in Washington and NAS Lemoore in California.

The objectives of the sound monitoring study included the following:

- Documenting the monitored sound levels
- Assessing the accuracy of DoD military aircraft noise models via comparisons with the monitored sound levels at NAS Whidbey Island and NAS Lemoore
- Recommending improvements to the noise modeling process

1.2 FY 2020 NDAA Summary Language

Section 325 of the FY 2020 NDAA, "Real-Time Sound-Monitoring at Navy Installations Where Tactical Fighter Aircraft Operate," states the following:

> **(a) MONITORING** — The Secretary of the Navy shall conduct real-time sound-monitoring at no fewer than two Navy installations and their associated outlying landing fields on the west coast of the United States where Navy combat coded F/A-18, E/A-18G, or F-35 aircraft are based and operate, and noise contours have been developed through noise modeling. Sound monitoring under such study shall be conducted—
>
> (1) during times of high, medium, and low activity over the course of a 12-month period; and
>
> (2) along and in the vicinity of flight paths used to approach and depart the selected installations and their outlying fields.
>
> **(b) PLAN FOR ADDITIONAL MONITORING —** Not later than 90 days after the date of the enactment of this Act, the Secretary of the Navy shall submit to the congressional defense committees a plan for real-time sound monitoring described in subsection (a) in the vicinity of training areas predominantly overflown by tactical fighter aircraft from the selected installations and outlying landing fields,

including training areas that consist of real property administered by the Federal Government (including Department of Defense, Department of Interior, and Department of Agriculture), State and Local governments, and privately owned land with the permission of the owner.

(c) REPORT REQUIRED — Not later than December 1, 2020, the Secretary of the Navy shall submit to the congressional defense committees a report on the monitoring required under subsection (a). Such report shall include—

(1) the results of such monitoring;

(2) a comparison of such monitoring and the noise contours previously developed with the analysis and modeling methods previously used;

(3) an overview of any changes to the analysis and modeling process that have been made or are being considered as a result of the findings of such monitoring; and

(4) any other matters that the Secretary determines appropriate.

(d) PUBLIC AVAILABILITY OF MONITORING RESULTS — The Secretary shall make the results of the monitoring required under subsection (a) publicly available on a website by the Department of Defense.

1.3 Real-Time Aircraft Sound Monitoring Study Overview

In conducting the monitoring for this study, the Navy relied on guidance outlined in the American National Standards Institute/Acoustical Society of America (ANSI/ASA) S12.9-1992/Part 2: Quantities and Procedures for Description and Measurement of Environmental Sound, Part 2, Measurement of Long-term, Wide Area Sound [1]. Consistent with ANSI/ASA procedures, the Navy conducted real-time sound monitoring of aircraft flight operations at NAS Whidbey Island and NAS Lemoore to allow a comparative analysis of actual measured sound levels with sound levels predicted by noise models. The analysis involved collecting sound measurements at specific locations and then comparing those measurements to previous noise results and contours as well as noise modeling conducted for this effort. At the airfields, the Navy collected data during periods of high, medium, and low flight activity during four discrete monitoring periods over a 12-month period. The Navy also collected data for 365 days at a site away from the airfield but near an airspace used for training. The monitoring team measured sound at selected monitoring sites along and in the vicinity of tactical fighter aircraft departures, arrival, and pattern flight paths and near training areas overflown by tactical jet aircraft. The Navy solicited input from local leaders, state and federal representatives, and interested federal agencies during the planning stage of this study in mid-2020. Stakeholder input received through two virtual meetings and multiple in-person engagements was a key component of the sound monitoring site selection process.

The Navy used the data collected during this study to assess the accuracy of the noise modeling process. For the airfields, the Navy compared the collected data against two modeling efforts: (1) modeling done specifically for this study using the observed flight operations data and (2) modeling completed as part of previous impact assessments at the two Navy installations. For the first comparison, the operational data collected during the monitoring periods were entered into a DoD-approved noise model, and the results were compared with measurements made during the monitoring periods. The first comparison is a better evaluation of the modeling process than using the previously modeled data as it eliminates operational variations that may have changed since previous modeling efforts were completed, such as sortie rates, runway and flight track utilizations, and time of day. The second comparison was of ***real-time measured data*** against ***previously modeled results***. This comparison of the ***real-time measured data*** with the ***previously modeled results*** allowed the Navy to determine if ***previously modeled results*** for each installation accurately predicted noise levels during periods of operational activity. The ***previously modeled results*** were provided in the *Environmental Impact Statement for EA-18G "Growler" Airfield Operations at Naval Air Station Whidbey Island Complex* (Growler EIS) [2] for NAS Whidbey Island and the *Environmental Impact Statement for U.S. Navy F-35C West Coast Homebasing* (F-35C West Coast Homebasing EIS) [3] for NAS Lemoore. The assumed basing projection in each study is yet to be realized because the projected basing of the aircraft is not yet completed.

For the monitoring site at the remote training area near NAS Whidbey Island, near the Olympic Military Operations Area (MOA) in the Olympic National Park, a different approach was taken because of the sporadic nature of the training events in that area and because the training flights in that area do not perform regular patterns within the airspace. For this monitoring site, acoustic data were collected for 365 days (20 October 2020 through 20 October 2021). The measured sound levels when the adjacent Olympic MOA was active were compared to the measured sound levels when the Olympic MOA was inactive to assess the military aircraft contribution to overall sound levels. The cumulative aircraft sound exposures at the MOA monitoring location were below the average sound levels from other sources, most of which were natural, so the Navy was unable to do a direct comparison of measured and modeled aircraft levels of sound exposure. This finding is consistent with the analysis contained in the *Northwest Training and Testing Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement* (Northwest Training and Testing SEIS/OEIS) [4].

1.4 Noise Modeling

In accordance with DoD policy outlined in DoD Instruction 4715.13 [5], the Navy assesses military noise-related issues associated with testing and training operations using the latest DoD-approved noise models. Per DoD policy, measurement of military noise is implemented only when modeling is not feasible. Noise modeling allows the Navy to cost-effectively consider alternative operational scenarios and develop noise contours to assist with impact assessments and long-term land use planning.

Noise is simply defined as unwanted sound. Appendix A provides more details on sound, metrics, and effects. DoD analyzes aircraft noise exposure that affects communities near military airfields using the NOISEMAP program. NOISEMAP is a suite of computer programs developed by the United States Air Force, which serves as the lead DoD agency for fixed-wing aircraft noise modeling. NOISEMAP predicts noise exposure based on aircraft flights and maintenance activities during an average annual day. NOISEMAP draws from a library of actual aircraft noise measurements obtained in a controlled environment and then incorporates the site-specific operations data (i.e., types of aircraft, number of operations, flight tracks, altitude, speed of aircraft, engine power settings, and engine maintenance run-ups), environmental data (i.e., average humidity and temperature), and surface hardness and terrain that contribute to the noise environment.

The MOA Range NOISEMAP (MRNMAP) tool is part of the NOISEMAP suite of computer programs. It calculates noise levels for restricted areas, MOAs, military training routes (MTRs), and ranges. MRNMAP uses two primary methods to calculate the noise exposure: area and track operations. *Area operations* are operations that do not have well-defined tracks but occur within a defined area, such as air combat tactics within a MOA. *Track operations* are operations that have a well-defined flight track, such as MTRs and aerial refueling tracks.

Atmospheric conditions, such as wind and temperature, can cause large variations in real-time received sound from day to day. Airfield noise modeling, including NOISEMAP and MRNMAP, considers long-term averages of the acoustical environment. Thus, NOISEMAP calculations assume more favorable conditions for the propagation of sound and, in so doing, these calculations tend to the higher range of potential received sound levels [6]. For example, even though NOISEMAP does not include the effect of wind explicitly, for purposes of prediction, it assumes that sound travels downwind, which is the most favorable condition for sound levels to be higher at a receiver location. For this reason, the model is expected to predict sound levels on the higher side of expected received levels. Appendix B provides more information on NOISEMAP and MRNMAP, and Appendix C details DoD noise study procedures.

1.5 Public Availability of Monitoring Results

This report was prepared to provide more detailed information in support of the Real-Time Aircraft Sound Monitoring report, which was submitted to Congress on 01 December 2021 [7]. The report provides a summary of methods, data, and results of real-time sound monitoring at NAS Whidbey Island, Washington, and NAS Lemoore, California.

The following technical data were collected during the real-time monitoring periods and used in the analysis of the sound monitoring study:

- Raw sound level meter data files
- Unified operational data for airfields
- MOA active periods
- Observer logs
- Flight event identification
- NOISEMAP input files
- NOISEMAP output files
- MRNMAP input files
- MRNMAP output files
- Real-time measured results

These data files are available to the public at:

https://www.navfac.navy.mil/products_and_services/am/products_and_services/Sound_Monitoring.html

The sound level meter files are in Larson Davis G4 binary format. These files can be accessed with Larson Davis G4 LD utility software, which can be downloaded free of charge at:

http://www.larsondavis.com/Products/software/g4-ld-utility-software

The airfield sound level meter data are organized in zip files; one for each monitoring location, which includes all four monitoring periods. The data for the sound level meter in Olympic National Park are also organized in zip files; one for each month of the year-long monitoring period. Section 3.2 provides more details on the sound level meter data.

This dataset also provides the airfield operational flight data, which are organized by each airfield and each monitoring period. The airspace operational data are contained in a single file, and they indicate the times that the airspace was active during the monitoring period. The website also includes observer logs. The logs document the following data: (1) field observations on the acoustic environment around the monitoring sites and (2) flight operations data at Outlying Landing Field (OLF) Coupeville. Section 3.3 describes these data items.

The data used in the analysis, and posted to the webpage, include noise event identification files (described in more detail in Section 4.1.1) and noise modeling input and output files. The noise modeling input files include: BaseOps files, terrain files, impedance files, and operational spreadsheets; the output files are text files with modeled results at each monitoring site. These files can be accessed with BaseOps utility software, which can be downloaded free of charge at:

http://dodnoise.org/primer_resources

2 DESIGN OF REAL-TIME SOUND MONITORING STUDY

Real-time sound monitoring was conducted at NAS Whidbey Island and NAS Lemoore to allow a comparative analysis of actual measured sound levels with sound levels predicted by noise models. Two types of data were required to complete this study: (1) real-time environmental sound levels and (2) real-time flight operations.

2.1 Measurement of Environmental Sound

The measurement of real-time environmental sound employed methods, procedures, and guidance from ANSI/ASA S12.9-1992/Part 2: Quantities and Procedures for Description and Measurement of Environmental Sound, Part 2, Measurement of Long-term, Wide Area Sound [1]. The environmental sound near NAS Whidbey Island and NAS Lemoore was measured during four discrete monitoring periods over a 12-month period.

2.1.1 Instrumentation, Operation, and Calibration

The monitoring team placed Larson Davis 831C Class I sound level meters at the same monitoring locations in each 7-day monitoring period for the two airfields. This type of meter was also used for the 365-day monitoring at the Olympic MOA. These meters are calibrated data recorders capable of high-fidelity sound capture over extended periods and adhere to industry standards [1]. They are not audio recorders and do not record as a personal recording device. Rather, they are sound level recorders, designed to respond to sound levels in the same way as a human ear and give reproducible measurements of sound pressure levels.

Each sound monitoring site's setup consisted of a sound level meter and wind monitor with the instrumentation protected in a lockable weather-tight case. The microphone used to record the sound level consists of an omni-directional, random incidence microphone and environmental pre-amplifier; the microphone is oriented vertically. A windscreen was placed over the microphone to reduce the effect of wind noise on the measured sound level.

The sound level meter was calibrated at the start of each monitoring period. In addition, a calibration tone was recorded for approximately 30 seconds at the start and end of each monitoring period.

During each monitoring period, each site was visited every few days for basic maintenance of the sound level meter. This maintenance process ensured positive data collection throughout each monitoring period. At the end of each monitoring period, the data were downloaded from the sound level meter, backed up to multiple hard drives and servers, inspected, and reviewed.

Some of the monitoring sites, like the year-long measurement of the Olympic MOA, employed a semi-permanent setup. These setups included a solar panel and rechargeable battery for continuous power and a cellular modem for remote access to the recorded data.

All meters were set to record data every 1 second, which allowed the meters to capture all sound sources in their vicinities. The data collected by the sound level meters are referred to in this report as the ***real-time acoustic data***.

2.1.2 Monitoring Site Selection for Airfields

The Navy selected NAS Whidbey Island, including OLF Coupeville, and NAS Lemoore for the monitoring effort. Both installations lie on the West Coast of the United States and host Navy combat-coded F/A-18, E/A-18G, or F-35 aircraft. Noise contours for these installations have been developed using standard DoD-approved noise-modeling tools, including NOISEMAP and MRNMAP.

The Navy selected NAS Whidbey Island due to public interest in the area's noise landscape and because of its varying topography, which influences aircraft noise propagation. The Navy selected NAS Lemoore as a second location due to its high level of flight activity, flat topography, and surrounding land uses that offer minimal variability and are conducive to consistent outdoor acoustic measurements.

General Process

The Navy used a spatial stratification analysis to determine suitable monitoring locations around the airfields at both installations. This analysis involved selecting sites to ensure sound measurements would capture a range of typical flight operations including aircraft arrivals, departures, patterns (e.g., field carrier landing practice [FCLP]), and interfacility flights. Selection of monitoring locations also took into consideration primary flight paths to offshore training areas and modeled flight tracks or overflight areas. In addition to spatial distribution, the sites also needed to provide a range of sound exposure levels (SELs).

The Navy also solicited input from local leaders, stakeholders, state and federal representatives, and interested federal agencies. Due to the outbreak of coronavirus disease 2019 (COVID-19), the Navy relied on virtual outreach methods to communicate with stakeholders. Between May and June 2020, the Navy hosted several virtual meetings with local leaders, external stakeholders, government representatives, and other federal agencies to gather input regarding potential monitoring locations. Based on this outreach, the Navy incorporated a total of eight monitoring sites (seven near NAS Whidbey Island and one near NAS Lemoore), suggested by local leaders and/or stakeholders, that also met the technical requirements for the study.

The Navy conducted the final site selection for the monitoring sites systematically to ensure each site met all technical requirements. The monitoring team conducted site visits in August 2020 and October 2020 for NAS Whidbey Island and NAS Lemoore, respectively, to confirm the viability of each potential site. To ensure accurate data collection, the Navy, to the greatest extent possible, selected sites having minimal external sound sources (e.g., cars, trains, commercial aircraft, or construction noise) and where the target source (military aircraft) was the dominant source of sound. Locations also had to be easily accessible, safe, and secure to deploy the sound level meter equipment. The Navy obtained access agreements to deploy sound level meters on properties not under DoD jurisdiction.

Monitoring Site Selection Criteria

Monitoring sites were selected based on multiple criteria. Three primary criteria included the range of flight types, propagation angle from flight tracks to a monitoring site, and previously modeled noise exposure levels. The range of flight types included the following:

- Departure
- Straight-in arrival: Visual Flight Rules (VFR) and Instrument Flight Rules (IFR)
- Overhead break arrival
- VFR patterns: FCLP and touch-and-go
- Ground controlled approach pattern
- Interfacility (NAS Whidbey Island only)

For the propagation angle, the grouping includes the following angular bands:

- Underneath – within 30° from overhead
- Away – greater than 60° from overhead
- In between – between 30° and 60° from overhead

For the selected sites, their primary flight type(s) were either within underneath or away bands to focus on different aspects of the acoustic propagation algorithms. Some sites may have included some flight types that were within the in-between band, but these flight type(s) are secondary for purposes of the comparison.

Prior noise modeling identified distributions of modeled day-night average sound level (DNL) or community noise equivalent level (CNEL) aircraft operations in the following A-weighted decibel (dBA) bands:

- 50 to 60 dBA DNL or CNEL
- 60 to 75 dBA DNL or CNEL
- > 75 dBA DNL or CNEL

The preferred location for most monitoring sites is within modeled areas in the 60- to 75-dBA DNL (or CNEL) band, because this band is the primary focus of noise exposure modeling for assessing potential community impacts and land use planning. Within the lower band (50 to 60 dBA DNL or CNEL), all land uses are compatible, but these lower levels are of interest to describe the noise environment. Within the higher band (> 75 dBA DNL or CNEL), very few land uses are compatible. For NAS Whidbey Island, the analysis used the noise model for the selected alternative (Alternative 2A) from the Growler EIS [2]. For NAS Lemoore, the analysis used the noise model for the selected alternative from the F-35C West Coast Homebasing EIS [3].

In addition to the technical selection criteria, the following logistical criteria parameters were used as supplemental factors for the potential sites:

- Access rights and restrictions
- Sound level meter security
- Cellular coverage and power supply (Site 99_HOH [*Hoh Rain Forest Visitor Center*] only)
- Other sound sources

Access to a site by the monitoring team was required to deploy and operate the sound level meter during the monitoring periods. Additionally, the sites needed to provide a secure deployment of the sound level meter and limit potential interference. The location of the sites ensured that aircraft noise was the dominant sound source with minimal interference from other sound sources (e.g., road traffic, commercial aircraft, construction activity).

NAS Whidbey Island

The Navy identified 11 monitoring sites adjacent to NAS Whidbey Island (Ault Field and OLF Coupeville), 7 of which were suggested by local stakeholders. Figure 1 shows the monitoring site locations.

The Navy used semi-permanent sound level meters at Site 33_SG (*Port Townsend City Hall*) and Site 5B_SG (*Lopez Island*) due to the difficulty in accessing both sites during the monitoring periods.

Figure 1. Location of Monitoring Sites Near NAS Whidbey Island

Table 1 lists the 11 selected monitoring sites in and around NAS Whidbey Island along with their criteria data.

A description of each monitoring site is provided below along with two photographs of the monitoring setup. The two photographs are representative of the monitoring setup used at each monitoring site for all four monitoring periods.

Table 1. Monitoring Sites Near NAS Whidbey Island and Selection Criteria Data

		Modeled[a] DNL (dBA)				Primary Flight Operation					
	Site ID and Name	**< 50**	**50 to 60**	**60 to 75**	**> 75**	**Departures**	**VFR/IFR Arrivals**	**Overhead Break Arrivals**	**VFR Pattern**	**GCA Pattern**	**Interfacility**
Ault Field	2B_T – Seaplane Base			✓		⚫				🔴	
Ault Field	3A_T – Skagit River Dike			✓			⚫			⚫	
Ault Field	5B_SG – Lopez Island		✓				🟢	🔴		🟢	
Ault Field	8B_SG – Dog Park				✓	🔴		⚫	⚫		
Ault Field	9B_SG – NASWI Gate				✓	🔴		🔴	🔴	🔴	🔴
OLF Coupeville	20B_SG – Perry House				✓				🔴		🔴
OLF Coupeville	24A_B – NPS Reuble Farm				✓				⚫		
OLF Coupeville	25B_T – Private Residence			✓					🔴		
OLF Coupeville	26B_SG – Reeder Bay				✓				⚫		⚫
OLF Coupeville	27A_SG – Coupeville Water Tower			✓					🔴		🔴
OLF Coupeville	33_SG – Port Townsend City Hall	✓							🔴		🔴

Key: < = less than; > = greater than; dBA = A-weighted decibels; DNL = day-night average sound level; GCA = ground-controlled approach; IFR = Instrument Flight Rules; NAS = Naval Air Station; NASWI = NAS Whidbey Island; NPS = National Park Service; VFR = Visual Flight Rules

⚫ = underneath flight operation; 🟢 = in-between flight operation; 🔴 = away flight operation

[a] Previously modeled values are from the Growler EIS [2]

Site 2B_T (*Seaplane Base*) was located on NAS Whidbey Island property 280 meters off Forest Drive within a lightly trafficked area of high vegetation and rocks, 40 meters from a water treatment area bordered by E Pioneer Way. The soundscape consisted of sporadic vehicles along Forest Drive, birds chirping, and residential activity in the Crescent Harbor Military Housing Area. Figure 2 displays the monitoring setup at Seaplane Base.

Figure 2. Monitoring Setup at Seaplane Base in December 2020 (left) and August 2021 (right)

Site 3A_T (*Skagit River Dike*) was located on a waterway feeding into Skagit Bay, adjacent to the Skagit Bay Estuary, and on private property off Rawlins Road 660 meters from Blake's Skagit Resort and Marina. The soundscape consisted of wind blowing through vegetation, birds chirping, insects buzzing, occasional vehicles along Rawlins Road (e.g., in August 2021, as many as 20 vehicles were present/parked), and light water lapping on the dike shore. Boats originating from the nearby marina and other launch areas sporadically passed the monitoring location, dominating the soundscape. Figure 3 displays the monitoring setup at the Skagit River Dike.

Figure 3. Monitoring Setup at the Skagit River Dike in December 2020 (left) and August 2021 (right)

Site 5B_SG (*Lopez Island*) was located on the southeast tip of Lopez Island, south of Watmough Bay and 500 meters from the Point Colville Trailhead on Watmough Head Road, elevated 28 meters above sea level at a 60-meter distance from the rocky shore. The soundscape consisted of wind blowing through vegetation, birds chirping, rare instances of people talking near the shoreline, and rare passing boats. Figure 4 displays the monitoring setup at Lopez Island.

Figure 4. Monitoring Setup at Lopez Island in December 2020 (left) and August 2021 (right)

Site 8B_SG (*Dog Park*) was located south of Ault Field on fenced-in NAS Whidbey Island property adjacent to the Clover Valley Park off W Ault Field Road, next to heavily forested vegetation and 80 meters from the dog park. The soundscape consisted of regular daytime traffic along W Ault Field Road, birds chirping, wind blowing through vegetation, sporadic aircraft idling on Ault Field, rare audible talking from the dog park, and construction sounds (in March 2021). Figure 5 displays the monitoring setup at the Dog Park site.

Figure 5. Monitoring Setup at the Dog Park Site in March (left) and August 2021 (right)

Site 9B_SG (*NASWI Gate*) was located on NAS Whidbey Island property behind a chain-link fence near the intersection of N Saratoga Street, W Banta Road, and Moran Road. The monitoring site was at the boundary between heavily forested vegetation on NAS Whidbey Island property and low-cut grass on private property. The soundscape consisted of aircraft run-up operations on Ault Field, vehicles sporadically passing on N Saratoga Street through the NAS Whidbey Island Hammer Gate base access point, irregular vehicles on Moran Road and W Banta Road, birds chirping, and wind blowing through vegetation. Figure 6 displays the monitoring setup at the NAS Whidbey Island Hammer Gate.

Figure 6. Monitoring Setup at the NAS Whidbey Island Gate in March (left) and August 2021 (right)

Site 20B_SG (*Perry House*) was located in a residential area south of OLF Coupeville, 1,330 meters from the arrival threshold of OLF Coupeville's Runway 32 and 145 meters from Highway 20 (W Wanamaker Road), off W Perry Drive. To the south of the Perry House is approximately 640 meters of marshland. The microphone was set at 12 feet off the ground to account for the wooden fence between the monitoring site and OLF Coupeville. This height ensured that the fence had minimal effect on the received aircraft noise. The soundscape consisted of sporadic vehicles passing on W Perry Drive, regular vehicles passing on W Wanamaker Road, birds chirping, and limited residential activity at the Perry House. Figure 7 displays the monitoring setup at the Perry House site.

Figure 7. Monitoring Setup at the Perry House Site in March (left) and August 2021 (right)

Site 24A_B (*NPS Reuble Farm*) was located west of OLF Coupeville, approximately 2,300 meters from the Runway 14 threshold, near the intersection of Fort Casey Road and W Patmore Road on the property of Reuble Farm. The National Park Service (NPS) operates Reuble Farm as part of Ebey's Landing National Historic Reserve. The soundscape consisted of farm equipment (e.g., tractor engines and irrigation systems), sporadic vehicles passing on Fort Casey Road and W Patmore Road, birds chirping, and wind blowing through the adjacent shrub. Figure 8 displays the monitoring setup at NPS Reuble Farm.

Figure 8. Monitoring Setup at NPS Reuble Farm in March (left) and August 2021 (right)

Site 25B_T (*Private Residence*) was located southeast of OLF Coupeville in a residential area 350 meters from the shoreline and off S Susan Street, in a grass-covered enclosed area near woody vegetation. The monitoring site was nearly 3,000 meters from the threshold of Runway 32 at OLF Coupeville. The soundscape consisted of rare vehicles along Coddington Road, S Susan Street, and Dalton Road; rare residential activity (e.g., lawn mowing); wind blowing through vegetation; and birds chirping. Figure 9 displays the monitoring setup at the Private Residence site.

Figure 9. Monitoring Setup at the Private Residence Site in March (left) and August 2021 (right)

Site 26B_SG (*Reeder Bay*) is located 7 meters from the shoreline on undeveloped residential property off N Reeder Road among a mix of grassy fields and trees. The Reeder Bay monitoring site is 2,700 meters north of the Runway 14 threshold at OLF Coupeville. The soundscape consisted of waves lapping on shore, wind blowing through vegetation, distant vehicles, birds chirping, distant people talking, and occasional construction noise approximately 200 meters away. Figure 10 displays the monitoring setup at Reeder Bay.

Figure 10. Monitoring Setup at Reeder Bay in March (left) and August 2021 (right)

Site 27A_SG (*Coupeville Water Tower*) was located atop a City of Coupeville water tower within a fenced-in area off W Wanamaker Road among forest vegetation. Access was limited to personnel with a ladder key. This monitoring site is nearly 1,500 meters southwest of the OLF Coupeville Runway 32 threshold. The soundscape consisted of wind blowing through vegetation, irregular traffic along W Wanamaker Road, and birds chirping. Figure 11 displays the monitoring setup at the Coupeville Water Tower.

Figure 11. Monitoring Setup at the Coupeville Water Tower in June (left) and August (right) 2021

Site 33_SG (*Port Townsend City Hall*) was located on the rooftop of the City Hall building at the corner of Madison Street and Water Street in Port Townsend, approximately 90 meters from the shoreline. The soundscape consisted of traffic along Water Street primarily and Madison Street secondarily (although the sound level meter was positioned in the center of the rooftop to shield traffic noise), seabirds squawking on adjacent buildings, elevated winds relative to street-level wind, people talking along Water Street and within Pope Marine Park, and heating, ventilation, and air conditioning (HVAC) noise. Figure 12 displays the monitoring setup at the Port Townsend City Hall.

Figure 12. Monitoring Setup at the Port Townsend City Hall in October (left) and December 2020 (right)

NAS Lemoore

The Navy identified 10 sound level meter monitoring sites on and adjacent to NAS Lemoore (Reeves Field). One of these 10 sites was suggested by NAS Lemoore stakeholders. Figure 13 depicts the monitoring locations for NAS Lemoore.

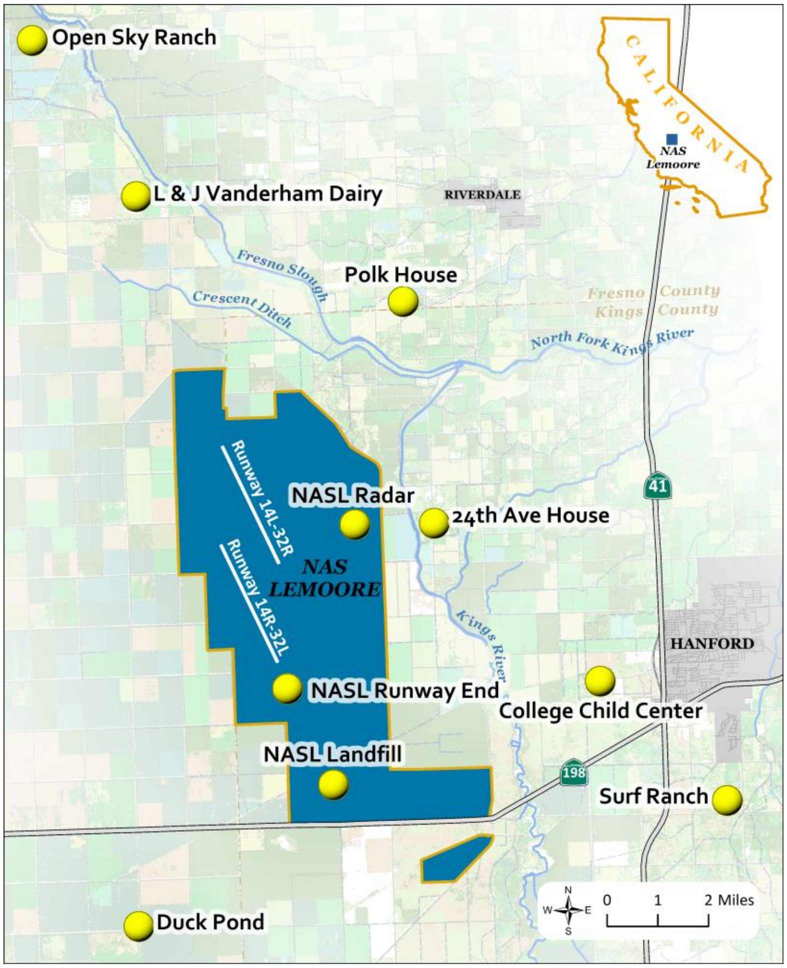


Figure 13. Location of Monitoring Sites Near NAS Lemoore

Table 2 lists the 10 monitoring sites in and around NAS Lemoore along with their criteria data.

A description of each monitoring site is provided below along with two photographs of the monitoring setup. The two photographs are representative of the monitoring setup used at each monitoring site for all four monitoring periods.

Table 2. Monitoring Sites Near NAS Lemoore and Selection Criteria Data

	Modeled[a] CNEL (dBA)				Primary Flight Operations				
Site ID and Name	< 50	50 to 60	60 to 75	> 75	Departures	VFR/IFR Arrivals	Overhead Break Arrivals	VFR Pattern	GCA Pattern
2_T - NASL Radar				✓			⚫	⚫	
3_T - 24th Ave House		✓			🔴		🔴	🔴	
4_T - Polk House			✓						⚫
6_T_N2 - L & J Vanderham Dairy			✓		🟢	⚫			⚫
9_T - Open Sky Ranch			✓		⚫	⚫			⚫
15_T - Duck Pond		✓					⚫		🔴
16_T_LF - NASL Landfill				✓		⚫	⚫		⚫
19_T_GC - Surf Ranch		✓			⚫				🔴
20_B - College Child Center		✓							🔴
21_T - NASL Runway End				✓		⚫	⚫	⚫	⚫

Key: < = less than; > = greater than; CNEL = community noise equivalent level; dBA = A-weighted decibels; GCA = ground-controlled approach; IFR = Instrument Flight Rules; NAS = Naval Air Station; NASL = NAS Lemoore; VFR = Visual Flight Rules

⚫ = underneath flight operation; 🟢 = in-between flight operation; 🔴 = away flight operation

[a] Previously modeled values are from the F-35C West Coast Homebasing EIS [3]

Site 2_T (*NASL Radar*) was located on NAS Lemoore property at a radar site off Grangeville Boulevard, approximately 2,760 meters east from the NAS Lemoore Runway 32R threshold. The soundscape consisted of insects and birds chirping, irregular traffic along Grangeville Boulevard, and distant jet engine run-ups. Figure 14 displays the monitoring setup at the NAS Lemoore Radar site.

Figure 14. Monitoring Setup at NAS Lemoore Radar Site in April (left) and August 2021 (right)

Site 3_T (*24th Avenue House*) was located on a residential property off 24th Avenue, approximately 5,150 meters from the threshold of NAS Lemoore Runway 32R. The soundscape consisted of sporadic large trucks and vehicles transiting along Grangeville Boulevard, birds squawking in the trees lining the residential driveway, rare vehicles along 24th Avenue, farm equipment and fence clanging sounds from Droogh and Georgeson Dairy, and cows mooing. Figure 15 displays the monitoring setup at the 24th Avenue House site.

Figure 15. Monitoring Setup at the 24th Avenue House Site in January (left) and August 2021 (right)

Site 4_T (*Polk House*) was located in the backyard of a residential property off S Polk Avenue and W Schilling Avenue, 7,400 meters northeast of the NAS Lemoore Runway 14L threshold. The soundscape consisted of humming sounds from agricultural equipment at adjacent farms, rare vehicles along W Schilling Avenue and S Polk Avenue, wind blowing through vegetation (palm trees), and insect and birds chirping. Figure 16 displays the monitoring setup at the Polk House site.

Figure 16. Monitoring Setup at Polk House Site in January (left) and August 2021 (right)

Site 6_T_N2 (*L & J Vanderham Dairy*) was located next to three large manure ponds on a multi-acre dairy farm off W Mt Whitney Avenue, 8,350 meters north from the NAS Lemoore Runway 14L threshold. The soundscape consisted of large trucks and grain-moving equipment operating on the dairy farm, vehicles along W Mt Whitney Avenue, cows clanging against fences, and bird chirping. Figure 17 displays the monitoring setup at L & J Vanderham Dairy.

Figure 17. Monitoring Setup at L & J Vanderham Dairy in January (left) and August 2021 (right)

Site 9_T (*Open Sky Ranch*) was located between a dairy farm and agricultural fields off W Elkhorn Avenue, nearly 14,200 meters northwest from the threshold of NAS Lemoore Runway 14L. The soundscape consisted of electric buzzing from Open Sky Ranch's administration building, rare passing vehicles on W Elkhorn Avenue, cows clanging against fences, and insects and bird chirping. Figure 18 displays the monitoring setup at Open Sky Ranch.

Figure 18. Monitoring Setup at Open Sky Ranch in January (left) and August 2021 (right)

Site 15_T (*Duck Pond*) was located under a grove of olive trees next to a pond on private property off S Jameson Avenue, 9,400 meters from the NAS Lemoore Runway 32L threshold. The soundscape consisted of ongoing water fountain splashing, birds cooing and singing, rare vehicles traveling on S Jameson Avenue, and constant distant traffic on Highway 198. Figure 19 displays the monitoring setup at the Duck Pond.

Figure 19. Monitoring Setup at the Duck Pond in April (left) and August 2021 (right)

Site 16_T_LF (*NASL Landfill*) was located within a fenced area on NAS Lemoore property adjacent to agricultural fields, 650 meters from Reeves Boulevard and 4,330 meters from the threshold of NAS Lemoore Runway 32L. The soundscape consisted of agricultural equipment, insects chirping, wind blowing through shrubs, and regular daytime vehicles traveling on Reeves Boulevard (with rare vehicle noise at night). Figure 20 displays the monitoring setup at the NAS Lemoore Landfill.

Figure 20. Monitoring Setup at the NASL Landfill in April (left) and May 2021 (right)

Site 19T_GC (*Surf Ranch*) was located on an inactive golf course between Jackson Avenue and 18th Avenue, 410 meters from wave-generating equipment and 15,000 meters from the threshold of NAS Lemoore Runway 32L. The soundscape consisted of infrequent daytime noise from vegetation maintenance equipment within the golf course, regular vehicles traveling along Jackson Avenue and 18th Avenue, birds chirping, and wind blowing through vegetation. Figure 21 displays the monitoring setup at the Surf Ranch.

Figure 21. Monitoring Setup at the Surf Ranch in January (left) and August 2021 (right)

Site 20_B (*College Child Center*) was located at the perimeter of the West Hills College Lemoore Child Development Center, off Bush Street and Marsh Drive, adjacent to a cultivated marsh and 10,330 meters from the threshold of NAS Lemoore Runway 32L. The soundscape consisted of noise from agricultural equipment operations adjacent to West Hills College Lemoore, distant HVAC noise, bird chirping, wind blowing through vegetation, and distant road noise. Figure 22 displays the monitoring setup at the Child Development Center site.

Figure 22. Monitoring Setup at the Child Development Center Site in April (left) and August 2021 (right)

Site 21_T (*NASL Runway End*) was located 950 meters from the threshold of NAS Lemoore Runway 32L on NAS Lemoore property off Reeves Boulevard. The soundscape consisted of whistling wind noise, vehicles traveling along Reeves Boulevard, rare security vehicles passing directly by the sound level meter, and rare operations of agricultural equipment adjacent to the runway enclosure. Figure 23 displays the monitoring setup at NAS Lemoore Runway End.

Figure 23. Monitoring Setup at the NAS Lemoore Runway End in January (left) and August 2021 (right)

2.1.3 Monitoring Site Selection for Training Airspace

Olympic MOA

The Navy placed a monitoring site (Site 99_HOH [*Hoh Rain Forest Visitor Center*]) within Olympic National Park near the Olympic MOA training airspace used by NAS Whidbey Island, based on an evaluation of sites suggested by the National Park Service. Figure 24 shows the position of the monitoring site relative to NAS Whidbey Island; the monitoring site is approximately 67 miles from NAS Whidbey Island.

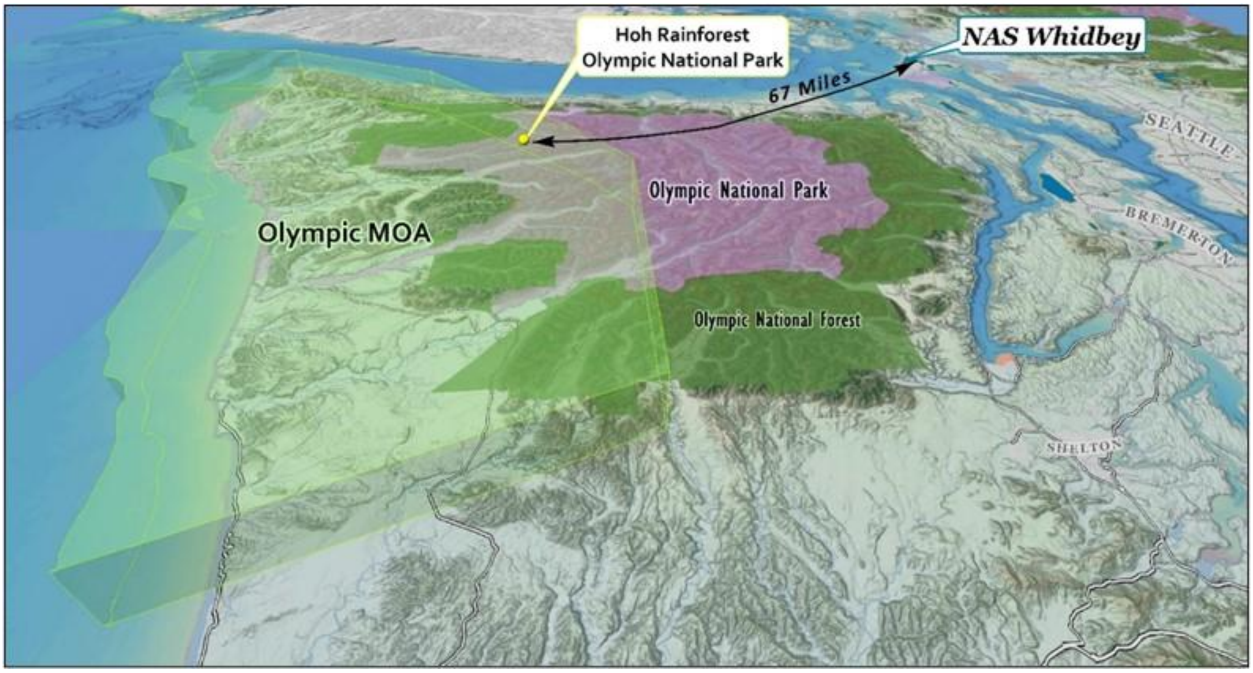


Figure 24. Location of Monitoring Site at Olympic National Park Relative to NAS Whidbey Island

Figure 25 shows the location of the monitoring site relative to Olympic National Park and the Olympic MOA. The monitoring site is in the Hoh Rain Forest Visitor Center area just outside the MOA boundary.

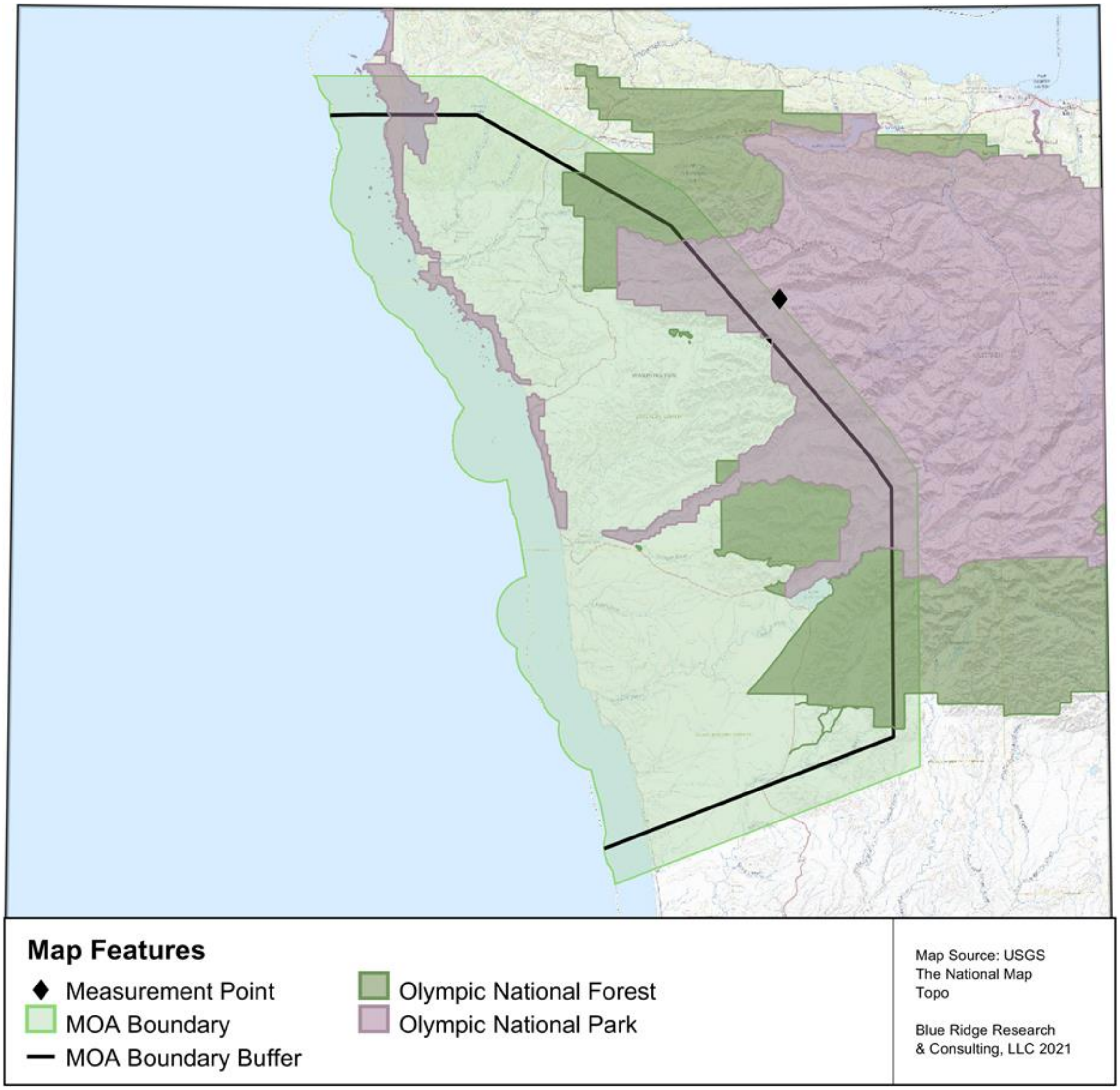


Figure 25. Location of Monitoring Site at Olympic National Park

At the Hoh Rain Forest Visitor Center site, the Navy used a semi-permanent sound level meter due to the sporadic nature of flight activity in this area and the remote location of the site. This location was selected because it met all three requirements for a semi-permanent sound level meter:

- Readily available AC power
- Quality cellular signal to support remote diagnostics and data download
- Easily accessible all year

The Hoh Rain Forest Visitor Center site was located within a fenced area adjacent to employee housing and surrounded by forest vegetation. The soundscape consisted of occasional generator buzzing, irregular daytime vehicles driven by employees (and rare nighttime vehicle traffic), distant traffic noise from visitors to the Hoh Rain Forest Visitor Center, wind blowing through vegetation, and bird and insect chirping. Figure 26 displays the monitoring setup at the Hoh Rain Forest Visitor Center site.

Figure 26. Monitoring Setup at the Hoh Rain Forest Visitor Center Site in October 2020

2.2 Collection of Flight Operations Data

2.2.1 Validation of Operational Data Package from Previous Studies

Historically, when the military determines that a new noise study is needed at an air station, the first step is to review previous noise study/modeling operational assumptions to validate and, where necessary, refine aircraft operational parameters. Aircrews will review and provide refinements to the operational data, if required. These refinements can reflect changes in local flight procedures or the aircrews' flight experience at the airfield. These refinements typically involve slight changes to engine power settings and altitude, and they provide a clearer description of the operations at the airfield. These types of refinements normally have minor influence on the resulting noise calculation.

NAS Whidbey Island

On-site interviews at NAS Whidbey Island of Air Traffic Control (ATC) personnel, EA-18G Fleet Squadron, Fleet Replacement Squadron (FRS), and Expeditionary Squadron pilots took place from 27 through 28 August 2020. The P-8 pilots were not available during the site visit, so a follow-up teleconference interview with the P-8 pilots took place on 01 September 2020. During these interviews, operational data, flight tracks, and flight profiles were collected for each squadron.

The operational data collected from the pilots included annual sorties and the number of closed patterns per sortie at Ault Field as well as at OLF Coupeville; percentage of operations during acoustic night (22:00 to 07:00); percentages of each type of arrival, departure, and pattern operations; traffic flow utilization; and engine run-up events. These operational data were consistent with the data used for the Growler EIS [2]. After review of the previously modeled flight tracks and flight profiles with the pilots, a few refinements were made to the existing flight tracks and flight profiles. These refinements allowed the real-time measured sound data to be merged effectively with real-time operational data for the purpose of comparing real-time measured, real-time modeled and previously-modeled sound levels. The refinements did not produce any significant change to the previous noise analysis results [2].

NAS Lemoore

Interviews with F-35C and F/A-18E/F FRS pilots at NAS Lemoore took place via teleconference on 06 October 2020. The F/A-18E/F and F-35C Fleet Squadron pilots were interviewed on 01 December 2020. During these interviews, operational data, flight tracks, and flight profiles were collected for each squadron and aircraft type. The operational data for several flight tracks and flight profiles needed to be refined from the data used for the F-35C West Coast Homebasing EIS [3]. The refinements did not result in any significant change to the noise analysis results in the previous analysis [3].

2.2.2 Operational Data Collection for Airfields

The real-time operational data collection involved at least two data sources: local ATC data collection and field observations.

Specific data were required to document and identify each flight operation. These real-time data included the following:

- Aircraft type
- Operation type (departure, arrival, and patterns)
- Runway number
- Associated modeled flight track with variations (traffic flow)
- Timestamp (when an aircraft leaves or touches down on a runway)
- Exceptions (non-modeled flight track or aircraft type)

ATC and Supplemental Data

ATC data included a combination of tower and radar inputs. These inputs provided the bulk of the required real-time operational data:

- Aircraft type
- Operation
- Runway
- Traffic flow
- Time stamp

For NAS Whidbey Island, ATC personnel collected operations data during each monitoring period using existing tower and radar data collection procedures. The monitoring team personnel collected supplemental operational data. For example, these supplemental data included break point, abeam distance for patterns, and initial departure turn points. The supplemental data were collected using a specialized computer application developed for this project.

The monitoring team collected the operational data for OLF Coupeville flight activity. These observations allowed the flight activity to be aligned with the previously modeled flight tracks and to be synched with the sound level meters around the OLF.

For NAS Lemoore, ATC personnel used the real-time data collect tool. The monitoring team observers were stationed outside of the Control Tower with clear views of the flight operations.

In addition to the type, timing, and duration of sound sources, the observers logged flight track and other operational variations or exceptions. Exceptions involved non-modeled flight tracks or profiles or aircraft types. Observers noted the exception and identified the closest flight track or aircraft type.

Supplemental Operational Data Collection Tool

Figure 27 shows an image from the prototype software program used for supplemental operational data collection. The program uses the noise modeling data from each airfield, which included all the flight tracks, flight profiles, and aircraft types used in the modeled data. This program allowed an observer to efficiently document the flight operations at the airfield. Within the user interface, observers filtered flight tracks according to the runway, aircraft, operation, and operation type. The program displayed the matching flight tracks for a given combination of aircraft type, runway, and operational type. The observer then selected the specific observed flight track, and the program stored the event in the table. The observer also added additional parameters, such as track or pattern distance and a timestamp.

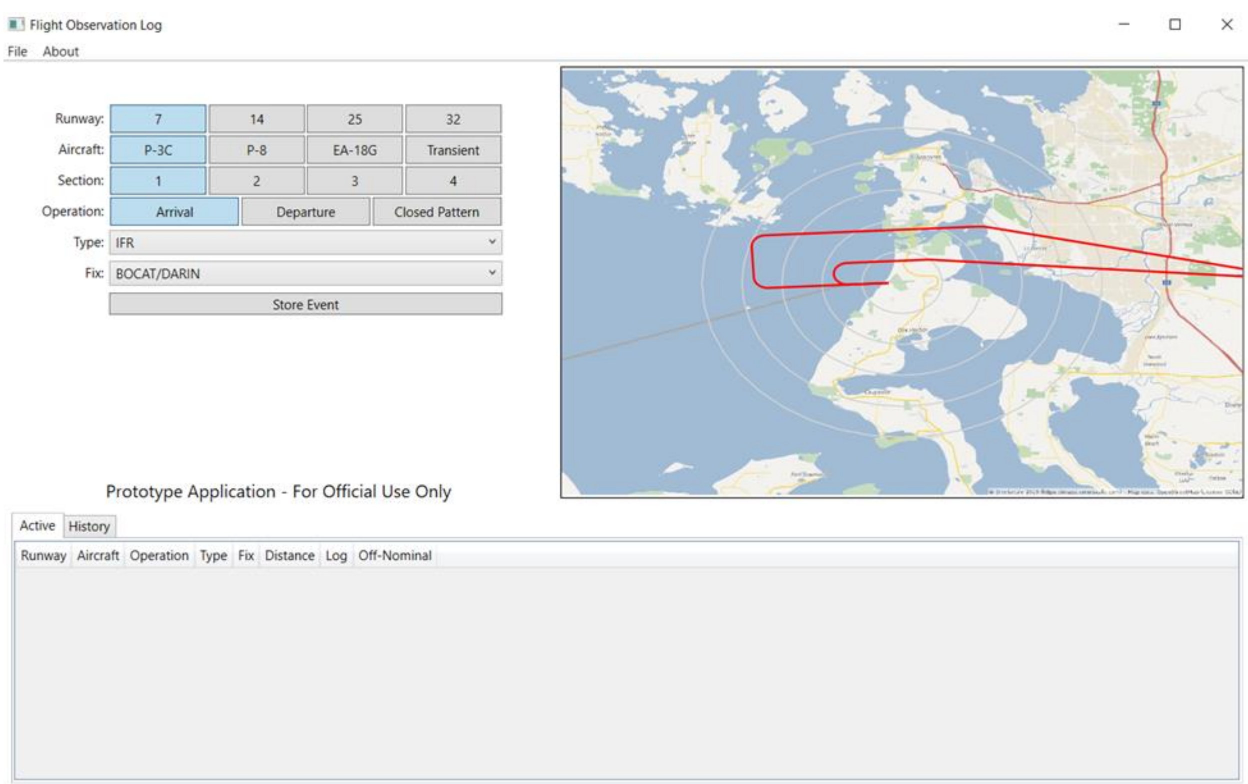


Figure 27. Prototype Application for Collecting Operational Data

The program allows for efficient documentation of flight operations to provide cross-correlation of the ATC operational data as well as the acoustic data.

2.2.3 Operational Data Collection for OLF Coupeville

The monitoring team performed field observations of the flight operations at OLF Coupeville. One observer was near the runway to document the touchdown time, and another observer was near the downwind leg to assess the width of the pass.

2.2.4 Operational Data Collection for Training Airspace

For the Olympic MOA, ATC at NAS Whidbey Island provided operations data collected for military activity, which included aircraft squadron type and estimated entry and exit times, to distinguish between actual times when the MOA was active and inactive. The data collection involved post-processing of paper flight strips[1] to estimate the time-of-day aircraft were entering and exiting the MOA. This process was non-standard, involving labor-intensive data collection, and provided a conservative number of sorties flying in the MOA. This additional data collection process to support this sound monitoring study was required to obtain the specific times aircraft were in the MOA. The operational data source used in the Northwest Training and Testing SEIS/OEIS [4] did not require specific timing information.

[1] A paper flight strip contains planned and current flight plan data for a specific flight. Air traffic controllers use these strips to know planned flight schedules as well as departure and arrival directions for the aircraft.

3 DATA COLLECTED FOR REAL-TIME SOUND MONITORING

3.1 Monitoring Periods

For the military airfields, the monitoring team collected real-time aircraft sound and operations data over four 7-day discrete monitoring periods in accordance with the ANSI/ASA standard. A 7-day monitoring period at a military airfield contains days of high (Tuesday through Thursday), medium (Monday and Friday), and low (Saturday and Sunday) flight activity. To capture data during different conditions, the Navy planned one monitoring period during each season (winter, spring, summer, and fall) at each airfield location.

Table 3 identifies each monitoring period and describes the flight activity and weather conditions. The monitoring periods took place during a range of weather conditions. The Navy planned the monitoring periods to coincide with flight activity at each installation. Since the Navy uses OLF Coupeville intermittently, monitoring periods for NAS Whidbey Island were scheduled when the OLF was in use. When OLF Coupeville is used, the most common aircraft activity is FCLPs, which simulate landing on an aircraft carrier. The overall flight activity is based on the average number of weekly flight operations occurring during the four monitoring periods at each airfield. The largest change in flight activity occurred between the first (53 percent) and fourth (187 percent) monitoring period at NAS Lemoore.

As noted in Section 1.3, the Navy initiated a 365-day monitoring period (20 October 2020 through 20 October 2021) for Site 99_HOH (*Hoh Rain Forest Visitor Center*) due to the sporadic nature of aircraft activity in the Olympic MOA; the longer monitoring period allowed the Navy to monitor more flights.

Table 3. Summary of Flight Activity and Weather Conditions for Each Monitoring Period

Monitoring Period	Overall Flight Activity[a]	Weather Conditions
NAS Whidbey Island		
13–19 December 2020	High (127% of average)	42 to 52 °F 0.55 inches of precipitation (windy and overcast)
28 March–03 April 2021	Medium (70% of average)	34 to 56 °F 0.15 inches of precipitation
06–12 June 2021	High (128% of average)	43 to 75 °F 0.08 inches of precipitation
08–14 August 2021	Medium (78% of average)	55 to 79 °F 0.06 inches of precipitation
NAS Lemoore		
24–30 January 2021	Low (53% of average)	28 to 60 °F 1.03 inches of precipitation (rainy)
11–17 April 2021	Medium (68% of average)	39 to 84 °F 0.0 inches of precipitation
16–22 May 2021	Medium (93% of average)	42 to 88 °F 0.0 inches of precipitation
22–28 August 2021	High (187% of average)	58 to 103 °F 0.0 inches of precipitation (smoky)

Key: °F = degrees Fahrenheit; NAS = Naval Air Station
Note:
[a] Overall flight activity averages are based on the sum of all of the monitored real-time flight operations divided by four (number of monitoring periods).

3.2 Acoustic Data

The Navy collected acoustic data at the airfields and the Olympic MOA using sound level meters following the ANSI/ASA technical guidelines. The Navy supplemented the acoustic data at the airfields with direct field observations to help identify non-aircraft sound sources near the sound level meters. Section 1.5 provides details on the public availability of all acoustic data.

Table 4 and Table 5 list total hours of the acoustic data collected during the monitoring effort for the airfields. Note that Table 4 does not include Site 99_HOH (*Hoh Rain Forest Visitor Center*), which recorded data over the course of a year (20 October 2020 through 20 October 2021). For NAS Whidbey Island, 11 sound level meters were deployed for each monitoring period, which resulted in up to 1,848 hours (7 days × 24 hours × 11 meters) of recorded acoustic data each period. For NAS Lemoore, 10 sound level meters were deployed for each monitoring period, which resulted in up to 1,680 hours (7 days × 24 hours × 10 meters) of recorded acoustic data each period. A brief data omission occurred during the first monitoring period at two specific sites due to cold weather, which drained the meter batteries faster than anticipated. The data omission at NAS Whidbey Island occurred at one site for approximately 15 hours, while the data omission at NAS Lemoore occurred at one site for approximately 14 hours. These hours occurred during periods of low flight activity and represent less than 1 percent of the collected hours of acoustic data.

Table 4. Summary of Total Hours of Acoustic Data Measurements at NAS Whidbey Island

Monitoring Period	Total Hours
13–19 December 2020	1,833
28 March–03 April 2021	1,848
06–12 June 2021	1,848
08–14 August 2021	1,848
Total	7,377

Key: NAS = Naval Air Station

Table 5. Summary of Total Hours of Acoustic Data Measurements at NAS Lemoore

Monitoring Period	Total Hours
24–30 January 2021	1,664
11–17 April 2021	1,680
16–22 May 2021	1,680
22–28 August 2021	1,680
Total	6,704

Key: NAS = Naval Air Station

3.3 Flight Operations Data

3.3.1 Airfield Operations Data

Table 6 provides an example of the unified flight operations data, and these data are referred to in this report as the ***real-time flight operations data***.

For each monitoring period, the monitoring team consulted with ATC and operations personnel for the planned daily flight schedule. This preplanning assisted in scheduling observers from the monitoring team for flight and acoustic observations.

For OLF Coupeville, FCLP operations are the primary contributors to the DNL at the five monitoring locations around the OLF. Thus, the measurement periods for this study coincided with planned FCLP activity at the OLF, which resulted in higher FCLP flight activity in the ***real-time flight operations data*** compared to the previously modeled flight operations data. The previously modeled flight operations data is based on an average annual day, which takes periods of inactivity into account.

Table 7 and Table 8 provide overall summaries of the flight operations data collected during the monitoring effort for NAS Whidbey Island and NAS Lemoore, respectively. For these summaries, one flight operation is counted whenever an aircraft touches or leaves a runway surface. Thus, an arrival and a departure each count as one flight operation, whereas a closed pattern, such as an FCLP, counts as two flight operations for each circuit.

Table 6. Example of the Unified Flight Operations Data

Operation ID	Runway	Aircraft	Sub-Type	Type	Fix	Distance	Log Time	Notes	Track ID
210330_U001	7	EA-18G	Departure	Departure	STILY	Center	3/30/21 08:31		07D1B
210330_U002	7	P-8	Departure	Departure	MCCUL	Center	3/30/21 08:36		07D2B
210330_U003	7	EA-18G	Departure	Departure	STILY	Center	3/30/21 08:59		07D1B
210330_U004	7	EA-18G	Departure	Departure	STILY	Long	3/30/21 08:59		07D1C
210330_U005	7	EA-18G	Departure	Departure	MCCUL	Center	3/30/21 09:01		07D2B
210330_U006	7	EA-18G	Departure	Departure	MCCUL	Long	3/30/21 09:01		07D2C
210330_U007	7	EA-18G	Departure	Departure	STILY	Center	3/30/21 09:02		07D1B
210330_U008	7	EA-18G	Departure	Departure	MCCUL	Center	3/30/21 09:22		07D2B
210330_U009	7	EA-18G	Departure	Departure	MCCUL	Long	3/30/21 09:23		07D2C
210330_U010	7	Transient	Departure	Departure	STILY	Center	3/30/21 09:25	Off-nominal	07D1B
210330_U011	7	EA-18G	Departure	Departure	STILY	Center	3/30/21 09:27		07D1B
210330_U012	7	P-3C	Departure	Departure	MCCUL	Center	3/30/21 09:36		07D2B
210330_U013	7	EA-18G	Departure	Departure	STILY	Center	3/30/21 09:39		07D1B
210330_U014	7	EA-18G	Overhead break arrival	Arrival	BOCAT/DARIN	Short	3/30/21 09:44		07O1A_FLT

Table 7. Summary of Real-Time Flight Operations at NAS Whidbey Island

Monitoring Period	Total Number of Operations[1]		Total Number of FCLP Operations	
	Ault Field	**OLF Coupeville**	**Ault Field**	**OLF Coupeville**
13–19 December 2020	1,038	1,224	306	1,112
28 March–03 April 2021	879	462	0	422
06–12 June 2021	1,752	766	172	694
08–14 August 2021	868	590	104	534
Total	**4,537**	**3,042**	**582**	**2,762**

Key: FCLP = field carrier landing practice; NAS = Naval Air Station; OLF = Outlying Field
[1] Total number of operations includes arrivals, departures, pattern operations, including FCLP operations, and interfacility operations. A single FCLP counts as two operations, one landing and one takeoff.

Table 8. Summary of Real-Time Flight Operations at NAS Lemoore

Monitoring Period	Total Number of Operations[1]	Total Number of FCLP Operations
24–30 January 2021	1,251	238
11–17 April 2021	1,815	254
16–22 May 2021	2,125	446
22–28 August 2021	2,802	1,320
Total	**7,993**	**2,258**

Key: FCLP = field carrier landing practice; NAS = Naval Air Station
[1] Total number of operations includes arrivals, departures, pattern operations, including FCLP operations, and interfacility operations. A single FCLP counts as two operations, one landing and one takeoff.

Table 9 provides the start and stop time for periods of FCLP flight activity at NAS Whidbey Island's OLF Coupeville. The start time indicates when the first aircraft performs their overhead break arrival to enter the FCLP pattern, and the stop time indicates when the last aircraft has departed OLF Coupeville enroute to Ault Field. Several periods listed in Table 9 represent multiple FCLP training periods conducted back-to-back.

The training period on 14 December 2020 was not included in the data analysis because training was cancelled after the pilots performed a flyby and determined the weather was unacceptable for training. The training period on 16 December 2020, starting at 14:30 and ending at 15:10, was also not included in the data analysis. The reason for this omission is no acoustic observations were made because of a schedule miscommunication; without acoustic observations this training period could not be included in the ***real-time modeled results*** for comparison.

Table 9. Summary of FCLP Start and Stop Times at OLF Coupeville

Monitoring Period	Date	Start Time[a]	Stop Time	Duration
13–19 December 2020	14 December	12:27	12:45	00:18[b]
	15 December	12:37	13:11	00:34
		14:29	15:01	00:32
		17:01	18:10	01:09
		18:31	19:40	01:09
	16 December	12:15	12:55	00:40
		14:30	15:10	00:40[c]
		16:54	19:53	02:59
	17 December	12:15	13:02	00:47
		14:30	15:05	00:35
		16:50	19:46	02:56
28 March–03 April 2021	29 March	13:58	14:35	00:37
		14:45	15:20	00:35
		19:26	20:50	01:24
	30 March	20:03	20:53	00:50
	31 March	20:04	20:43	00:39
	01 April	15:32	16:23	00:51
		20:02	20:37	00:35
06–12 June 2021	07 June	21:11	21:54	00:43
		22:15	23:21	01:06
	08 June	21:28	22:12	00:44
		22:18	23:50	01:32
	09 June	21:35	22:15	00:40
		22:20	23:30	01:10
	10 June	15:55	16:31	00:36
		17:28	18:13	00:45
		21:39	23:20	01:41
08–14 August 2021	09 August	20:32	21:20	00:48
		22:00	22:53	00:53
	10 August	15:22	15:53	00:31
		20:41	21:23	00:42
		22:05	22:50	00:45
	12 August	11:34	12:26	00:52
		12:57	13:43	00:46

Key: FCLP = field carrier landing practice; OLF = Outlying Field
Notes:
[a] Times are given in 24-hour time notation.
[b] FCLP was cancelled after only a few touchdowns due to weather. Period is not included in analysis.
[c] No acoustic observations were made at OLF Coupeville during this FCLP. Period is not included in analysis.

3.3.2 Training Airspace Operations Data

A summary of sortie data for Olympic MOA is provided in Table 10. The table provides the distribution of acoustic day and night events and the overall sorties for each month. The day and night events can be more than the total sorties since a sortie may cross over 22:00, which create both a day and night event.

Table 10. Summary of Real-Time Flight Operations for Olympic MOA

Month	Acoustic Day Events (07:00 to 22:00)	Acoustic Night Events (22:00 to 07:00)	Total Sorties[1]
October 2020	135	12	142
November 2020	269	5	269
December 2020	248	0	248
January 2021	253	0	253
February 2021	344	2	344
March 2021	321	0	321
April 2021	235	15	235
May 2021	274	0	274
June 2021	313	44	315
July 2021	277	9	277
August 2021	318	11	320
September 2021	241	6	241
October 2021	216	10	218

Key: MOA = Military Operations Area

[1] The total sorties may be less than the sum of acoustic day and acoustic night events if some of the sorties entered before 22:00 and exited afterward.

3.3.3 Aircraft Basing Levels

The current aircraft basing level for each airfield was calculated and compared to the projected basing level identified in the Growler EIS [2] for NAS Whidbey Island and the for F-35C West Coast Homebasing EIS [3] for NAS Lemoore.

NAS Whidbey Island

At NAS Whidbey Island, the based squadrons are at the following levels relative to the projected levels:

- EA-18G squadron types:
  - Fleet, 70 percent
  - Expeditionary, 100 percent
  - Fleet Replacement, 100 percent
  - Reserve, 100 percent
- P-8 aircraft are at 100 percent.
- 17 P-3Cs are still based at NAS Whidbey Island, whereas the Growler EIS assumed 0 aircraft.

The number of EA-18G aircraft supporting the Fleet squadrons has yet to reach 100 percent relative to the projected levels.

The 17 P-3Cs still based as NAS Whidbey Island are expected to have a marginal effect on the real-time measured DNL because of the low noise levels produced by this aircraft.

NAS Lemoore

At NAS Lemoore, the based squadrons are at the following levels relative to the projected levels:

- F/A-18E/F squadron types
  - Fleet at 100 percent
  - Fleet Replacement at 100 percent
- F-35C squadron types
  - Fleet at 14 percent
  - Fleet Replacement at 63 percent

The number of F-35C aircraft supporting Fleet and Fleet Replacement Squadrons has yet to reach 100 percent relative to the projected levels.

3.4 Observation Logs

The monitoring team also conducted observations near the sound level meters to help identify non-aircraft sound sources picked up by the meters. The monitoring team scheduled observation locations at or near specific meters based on expected runway use and flight operational tempo for each day. The monitoring team noted all audible sound sources it observed at each observation site, an example of which is shown in Figure 28. As noted, the only aircraft observed was a general aviation aircraft (GA Propeller).

Location 27A_SG: Water Treatment Plant
Recorder XXXXXXXXXXXXXX
Date 8-Aug-21
Ctrl + Shift + T: Hot Key in for current time in seconds

Start Time	End Time	Stamp	Aircraft	Sound Source	Description	NOTE:
10:20:36 AM					Arrival at the site. Ambient: 1. birds 2. nearby traffic 3. wind through the trees	
10:23:42 AM	10:24:33 AM		GA Propeller		GA Prop overflight (directly over the site)	
10:25:56 AM	10:26:08 AM			Nearby Traffic	car driving by the site on the main road	
10:29:47 AM	10:30:03 AM			Nearby Traffic	car driving by the site on the main road	
10:30:37 AM	10:30:42 AM			Nearby Traffic	car driving by the site on the main road	
10:33:07 AM	10:34:37 AM		GA Propeller		GA Prop overflight (directly over the site)	
10:36:48 AM	10:37:00 AM			Nearby Traffic	car driving by the site on the main road	
10:38:18 AM	10:38:35 AM			Nearby Traffic	three cars driving by the site	
10:41:22 AM	10:41:38 AM			Nearby Traffic	loud pickup truck driving by the site	
10:42:31 AM	10:42:50 AM			Nearby Traffic	car pulled into the gravel parking at the site then turned around	
10:44:35 AM	10:47:02 AM		GA Propeller		GA Prop nearby (offset)	
10:48:16 AM	10:49:48 AM		GA Propeller		GA Prop nearby (offset)	
10:50:07 AM	10:50:21 AM			Nearby Traffic	three cars driving by the site	
10:50:59 AM	10:51:05 AM			Nearby Traffic	car driving by the site on the main road	
10:51:56 AM	10:52:05 AM			Nearby Traffic	FedEx truck driving by the site	
	10:52:26 AM				End of Observations	

Figure 28. Example Sound Observation Log

4 DATA ANALYSIS

The data analysis process included identifying aircraft noise events, calculating sound metrics, and comparing the measured data to modeled results. Figure 29 provides an overview of the process.

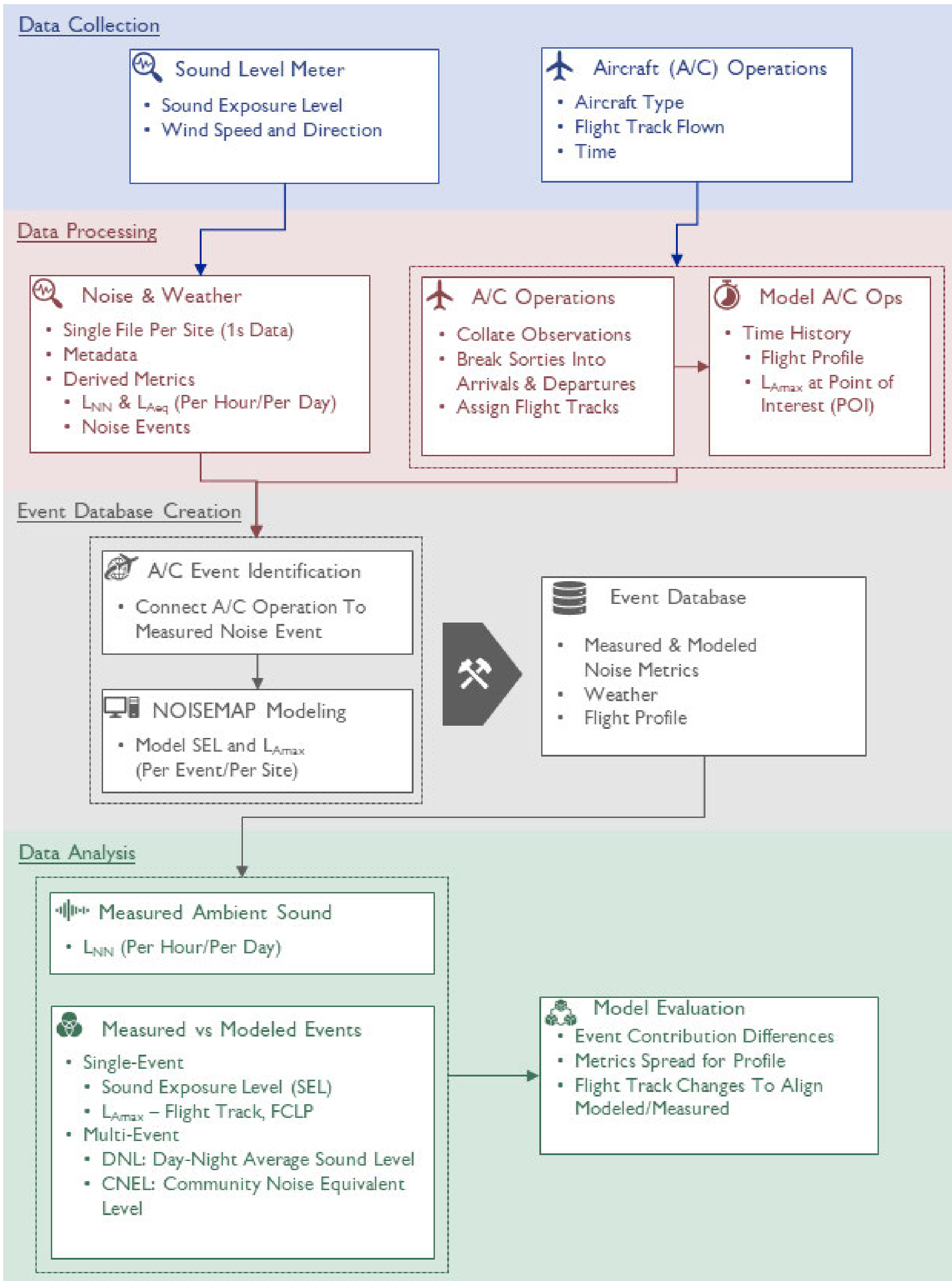


Figure 29. Data Analysis Process Diagram

4.1 Airfield Analysis

4.1.1 Identifying Aircraft Noise Events

The real-time measured noise events from Navy aircraft flight operations must be identified to facilitate a comparison to the noise models. Identifying aircraft noise is a two-step process: (1) identify noise events and (2) align ***real-time flight operations data*** to noise events.

The monitoring team used two international standards as guidance material for identifying aircraft noise events:

- International Organization for Standardization (ISO) 20906:2009, Acoustics – Unattended monitoring of aircraft sound in the vicinity of airports [8].
- Aerospace Recommended Practice (ARP) 4721/1, Monitoring Aircraft Noise & Operations in the Vicinity of Airports: System Description, Acquisition, and Operation [9].

The ISO 20906:2009 standard provides a generalized process for identifying aircraft noise events for continuous airport monitoring situations. This ISO standard is developed to support unattended aircraft monitoring at public airports, but the process also applies to this study. Figure 30 shows the process overview from ISO 20906:2009, and details on the four steps in the process are provide in the following text.

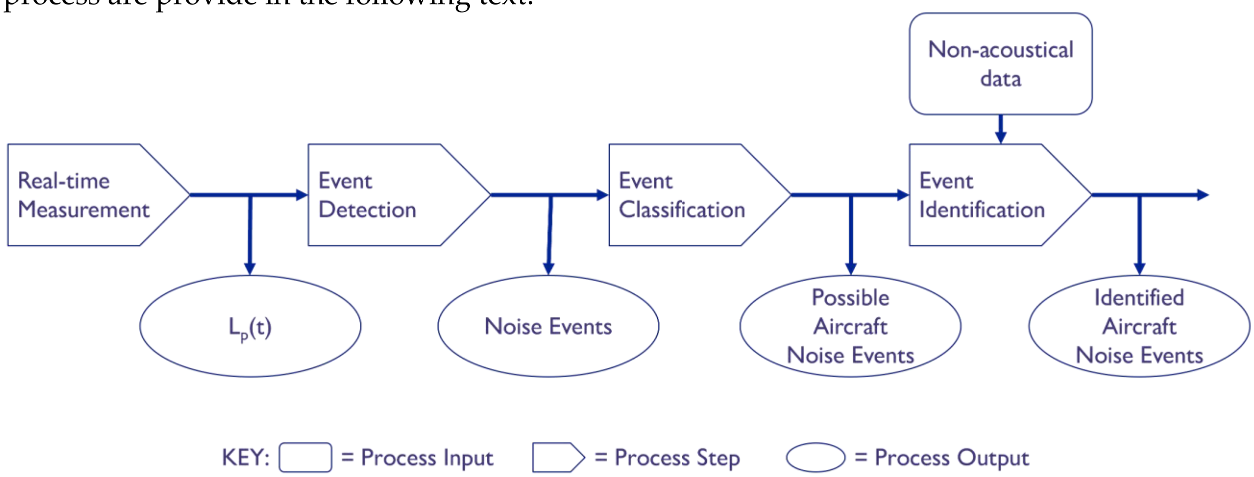


Figure 30. Generalized Process for Identifying Aircraft Noise Events from ISO 20906:2009

Real-Time Measurement

The sound level meters stationed at every site recorded the real-time continuous sound level, $L_p(t)$, at 1-second intervals. These data are saved directly to the sound level meter and then downloaded at the end of every monitoring period in preparation for aircraft noise event identification and sound metrics calculations.

Event Detection

ISO 20906:2009 recommends classifying a noise event when (1) the sound is not steady state but also not impulsive; (2) the sound exceeds a threshold level by at least a specified amount; (3) when an event terminates, the sound level does not rise above a specified level within a specific time. All three of these criteria were used to establish noise events for this study.

The sound level time-history used for event detection was a 10-second moving mean of the real-time measured sound level data to minimize minor variations in the high sampling rate measured data.

The detection threshold for noise events varied with ambient conditions, as recommended by ARP 4721/1 [9], because it improves the ability to lower the threshold during periods of the day when the ambient sound levels are low. The threshold that the sound level was required to exceed was set to L_{90} + 10 dBA, where L_{90} is the 90th percentile sound level for the hour (± 30 minutes). That is, for 90 percent of the hour, the sound levels are above this level; the L_{90} is analogous to the background sound level. The threshold is set to 10 dBA above L_{90} to only capture distinct noise events. The smoothed signal ensured that momentary impulsive noise events were disregarded.

An event terminates when the "smoothed" sound level falls below the detection threshold. The sound level was required to stay below the detection threshold for 5 seconds to ensure that the noise event had truly terminated.

An aircraft flyover noise event has a characteristic shape; Figure 31 shows an example (the X-axis shows time in 24-hour time notation on this and similar graphs). The sound level has a steep rise, reaching a maximum level, followed by a gradual decay.

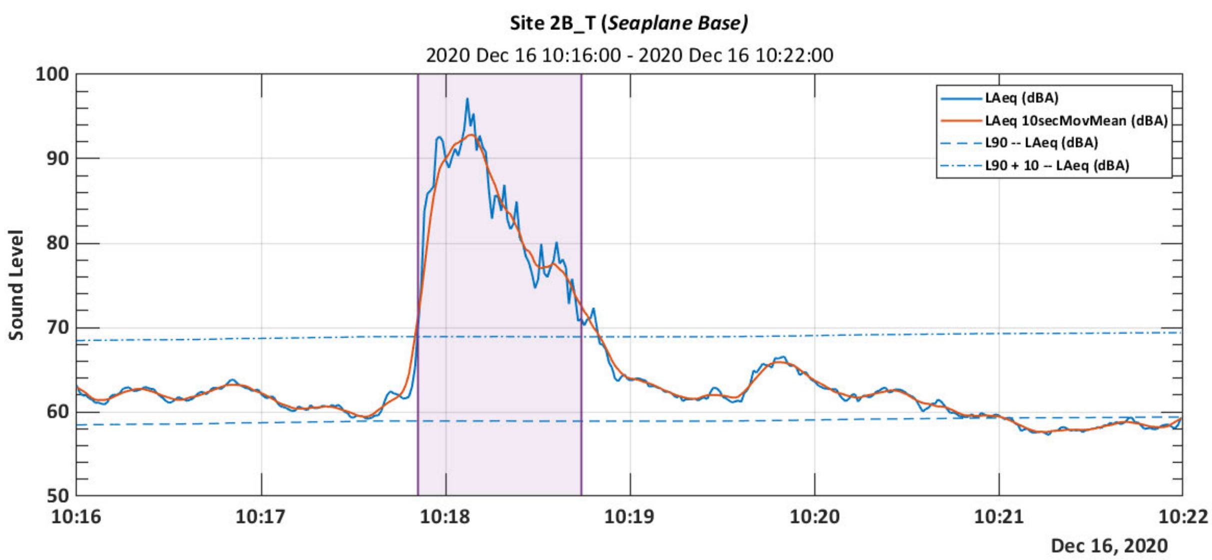


Figure 31. Example Aircraft Noise Event – One Peak

Additional considerations were required when identifying noise events for this study because Navy aircraft operate differently than commercial aircraft—Navy aircraft may fly in groups of two or more. When multiple Navy aircraft fly close together, additional peaks in the sound level can be observed during the noise event. Figure 32 shows two Navy aircraft departing from NAS Whidbey Island Runway 14 within 20 seconds of each other. The sound level from the first aircraft is not able to fall below the detection threshold before the second aircraft flies overhead. Instead, the sound level rises again, before gradually decaying.

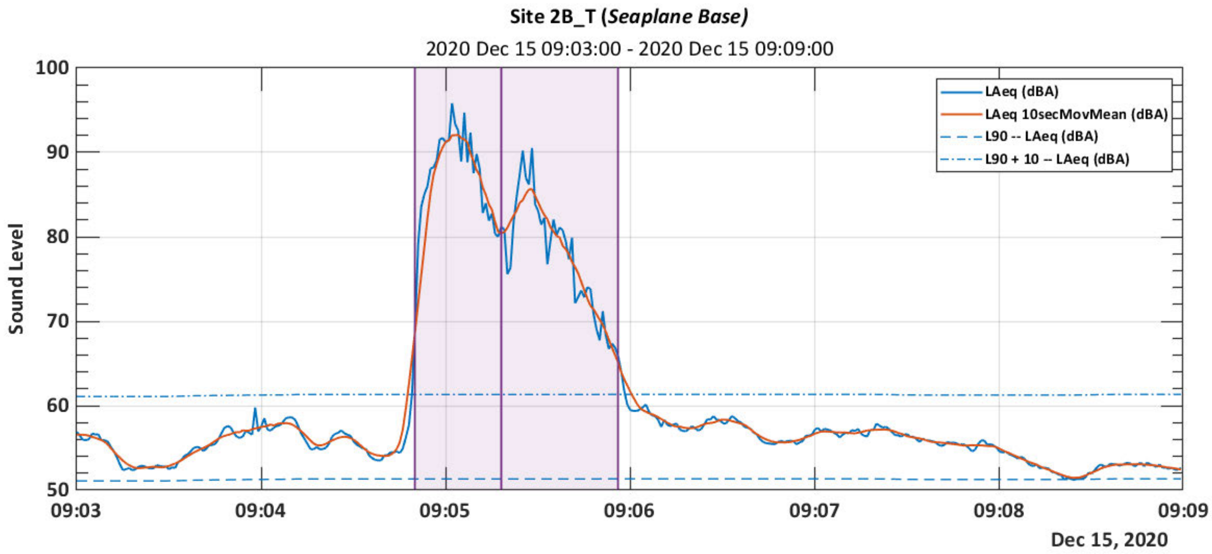


Figure 32. Example Aircraft Noise Event – Two Peaks

Each noise event was screened a second time to identify multiple peaks in the sound level of the "smoothed" signal. If additional peaks were found, the noise event was split into multiple, shorter-duration noise events. This effort was done to better allocate specific noise events to specific aircraft operations.

In cases where the sound level rises significantly above the detection threshold, ISO 20906:2009 recommends shifting the start and stop times of each noise event to when the sound level is within 10 dBA of L_{Amax}. The standard recommends only including noise within 10 dBA of the maximum sound level because this noise can be assumed to come from a single source (e.g., an aircraft flyover) and is likely not corrupted by sound from other sources (e.g., traffic). This concept was extended for this study. The start and stop times of noise events were shifted to when the sound level is within 20 dBA of L_{Amax}, allowing the noise event to better encompass all the energy from a Navy aircraft flyover.

Event Classification and Event Identification

ISO 20906:2009 and ARP 4721/1 recommend using aircraft time and position information to correlate an aircraft operation with a noise event. This time and position information provides confidence that the noise event is due to an aircraft and not some other source. Public airports that perform sound monitoring use ATC radar data to determine the time and position of each aircraft. The Navy does not collect this type of time and position data from their radars, so a kinetic model of the modeled flight trajectories was used to estimate aircraft time and position for this project.

The calculated time history, combined with the real-time operation data, was used to estimate the time when the aircraft would be at its closest point of approach. Noise events near the time of closest approach, plus propagation time, were classified as possible aircraft noise events. If the process identified only one possible noise event, that event was associated with the specific real-time flight operation. If the process identified multiple noise events, the noise event at the time of closest approach plus propagation time was associated with the specific real-time flight operation, but all possible events were cataloged.

Event Database

The event classification process developed an event database that cataloged all acoustic exceedance events, and the database lists the acoustic metrics for each event and the flight operation associated with that event. The database facilitated comparison of the monitored data captured during the monitoring session to modeled data.

4.1.2 Calculating Sound Metrics

The following information was cataloged for each noise event:

- Event ID – unique identifier for the noise event
- Start time/stop time – timestamps defining the boundaries of each noise event
- SEL – sound exposure level
- L_{Aeq} – equivalent continuous sound level
- L_{Amax} /time of L_{Amax} – maximum sound level of the noise event and its timestamp

If a noise event was classified as an aircraft noise event, the operation ID (a unique identifier associated with each real-time flight operation) was also cataloged. The operation ID allowed for noise event metrics to be tied to a specific operation. Cumulative sound metrics, like DNL and CNEL, were calculated from the SEL associated with each aircraft noise event. Appendix A.4 provides definitions for the sound metrics used in this study.

Calculating DNL for a Monitoring Site

The real-time measured DNL was calculated from the SEL associated with each aircraft noise event for each monitoring site every day. The process consists of four distinct steps:

1. Categorize aircraft noise events as daytime or nighttime aircraft noise events
2. Calculate DNL for a single day
3. Calculate the DNL for a single monitoring period as the energy average of each day's DNL
4. Calculate the DNL for all monitoring periods as the energy average of each period's DNL

Categorizing Aircraft Noise Events by Acoustic Time of Day

In step 1 of the process, each aircraft noise event is categorized as a daytime or a nighttime aircraft noise event. A daytime event must start and end between 07:00 and 22:00, while a nighttime event must start and end between 22:00 and 07:00. If an event occurs during the transition from day to night (22:00) or the transition from night to day (07:00), the event is considered a nighttime event.

Calculation of Real-Time Measured DNL from Aircraft Noise Events

In step 2 of the process, the DNL for a single day is calculated using eq. (1) [10]:

$$DNL_{SingleDay} = 10\log_{10}\left[\left(\frac{15}{24}\right)\left(\frac{1}{T_d}\right)\sum_{i=1}^{N_{Day}} 10^{\frac{SEL_i}{10}}\right] + 10\log_{10}\left[\left(\frac{9}{24}\right)\left(\frac{1}{T_n}\right)\sum_{i=1}^{N_{Night}} 10^{\frac{SEL_i+10}{10}}\right] \tag{1}$$

where

- $DNL_{SingleDay}$ is the DNL for the day
- T_d is 54,000 (the number of seconds in the 15 daytime hours)
- N_{Day} is the number of aircraft noise events during acoustic daytime (07:00 to 22:00)
- SEL_i is the SEL associated with a single aircraft noise event
- T_n is 32,400 (the number of seconds in the 9 nighttime hours)
- N_{Night} is the number of aircraft noise events during acoustic nighttime (22:00 to 07:00)

Note that a 10 dB adjustment is applied to the SEL for each nighttime aircraft noise event.

In step 3 of the process, the DNL for the monitoring period is calculated as the energy average DNL across all seven days (eq. (2)).

$$DNL_{MonitoringPeriod} = 10\log_{10}\left[\left(\sum_{iDay=1}^{7} 10^{\frac{DNL_{iDay}}{10}}\right)/\,7\right] \tag{2}$$

where

- $DNL_{MonitoringPeriod}$ is the DNL for the monitoring period
- DNL_{iDay} is the DNL for a single day

Finally, in step 4 of the process, the real-time measured DNL for a site is calculated as the energy average DNL across all four monitoring periods (eq (7)).

$$DNL_{Real-TimeMeasured} = 10\log_{10}\left[\left(\sum_{iPeriod=1}^{4} 10^{\frac{DNL_{iMonitoringPeriod}}{10}}\right)/4\right] \tag{3}$$

where

- $DNL_{Real-TimeMeasured}$ is the DNL for the monitoring site
- $DNL_{iMonitoringPeriod}$ is the DNL for a single monitoring period

The $DNL_{Real-TimeMeasured}$ is the DNL utilized in the comparison with modeled results.

Calculating CNEL for a Monitoring Site

The same four step process was employed to calculate the real-time measured CNEL. The process is identical, however, CNEL also includes adjustments for aircraft noise events that occur during acoustic evening (19:00 to 22:00).

Categorizing Aircraft Noise Events by Acoustic Time of Day

In step 1 of the process, each aircraft noise event is categorized as a daytime, evening, or nighttime aircraft noise event. A daytime event must start and end between 07:00 and 19:00, an evening event must start and end between 19:00 and 22:00, and a nighttime event must start and end between 22:00 and 07:00. If an event occurs during the transition from day to evening (19:00), the event is considered an evening event. If an event occurs during the transition from evening to night (22:00) or the transition from night to day (07:00), the event is considered a nighttime event.

Calculation of Real-Time Measured CNEL from Aircraft Noise Events

In step 2 of the process, the CNEL for a single day is calculated using eq. (4) [10]:

$$
\begin{aligned}
CNEL_{SingleDay} = {} & 10\log_{10}\left[\left(\frac{12}{24}\right)\left(\frac{1}{T_d}\right)\sum_{i_{Day}=1}^{N_{Day}} 10^{\frac{SEL_{i_{Day}}}{10}}\right] \\
& + 10\log_{10}\left[\left(\frac{3}{24}\right)\left(\frac{1}{T_e}\right)\sum_{i_{Evening}=1}^{N_{Evening}} 10^{\frac{SEL_{i_{Evening}}+4.77}{10}}\right] \\
& + 10\log_{10}\left[\left(\frac{9}{24}\right)\left(\frac{1}{T_n}\right)\sum_{i_{Night}=1}^{N_{Night}} 10^{\frac{SEL_{i_{Night}}+10}{10}}\right]
\end{aligned}
\tag{4}
$$

where

- $CNEL_{SingleDay}$ is the CNEL for the day
- T_d is 43,200 (the number of seconds in the 12 daytime hours)
- N_{Day} is the number of aircraft noise events during acoustic daytime (07:00 to 19:00)
- SEL_i is the SEL associated with a single aircraft noise event
- T_e is 10,800 (the number of seconds in the 3 evening hours)
- $N_{Evening}$ is the number of aircraft noise events during acoustic evening (19:00 to 22:00)
- T_n is 32,400 (the number of seconds in the 9 nighttime hours)
- N_{Night} is the number of aircraft noise events during acoustic nighttime (22:00 to 07:00)

Note that a 4.77 dB adjustment is applied to the SEL for each evening aircraft noise event and a 10 dB adjustment is applied to the SEL for each nighttime aircraft noise event [11].

In step 3 of the process, the CNEL for the monitoring period is calculated as the energy average CNEL across all seven days (eq. (5)).

$$
CNEL_{MonitoringPeriod} = 10\log_{10}\left[\left(\sum_{iDay=1}^{7} 10^{\frac{CNEL_{iDay}}{10}}\right)/\,7\right] \tag{5}
$$

where

- $CNEL_{MonitoringPeriod}$ is the CNEL for the monitoring period
- $CNEL_{iDay}$ is the CNEL for a single day

Finally, in step 4 of the process, the real-time measured CNEL for a site is calculated as the energy average CNEL across all four monitoring periods (eq (6)).

$$
CNEL_{Real-TimeMeasured} = 10\log_{10}\left[\left(\sum_{iPeriod=1}^{4} 10^{\frac{CNEL_{iMonitoringPeriod}}{10}}\right)/4\right] \tag{6}
$$

where

- $CNEL_{Real\text{-}TimeMeasured}$ is the CNEL for the monitoring site
- $CNEL_{iMonitoringPeriod}$ is the CNEL for a single monitoring period

The $CNEL_{Real\text{-}TimeMeasured}$ is the CNEL utilized in the comparison with modeled results.

4.2 OLF Coupeville FCLP Data Analysis

The sound analysis of FCLP operations at OLF Coupeville presented challenges to the aircraft noise event identification process described in Section 4.1.1. The challenge arises from multiple aircraft flying in the same basic pattern with overlapping noise events. Figure 33 (page 47) provides an example of the ***real-time measured data*** during one FCLP session at OLF Coupeville. For this session, the FCLP operations were conducted on Runway 14, so Site 26B_SG (*Reeder Bay*) was directly overflown, and flights were close to Site 25B_T (*Private Residence*) at the closest point of approach. At these two sites, individual aircraft noise events are evident and occur when each aircraft is near the closest point of approach to the monitoring site. However, aircraft noise events overlapped significantly at Site 24A_B (*NPS Reuble Farm*), Site 27A_SG (*Coupeville Water Tower*), and Site 20B_SG (*Perry House*) since these sites were on the opposite side of the FCLP flights. At Site 33_SG (*Port Townsend City Hall*), no discernable aircraft noise events were seen in the ***real-time measured data***. Thus, calculating the real-time measured DNL using the formulas outline in Section 4.1.2 is not technically feasible at those sites where aircraft noise events overlapped significantly or could not be discerned.

A separate methodology, as shown in equation (7), is used to calculate the DNL due to FCLP activity for a single day.

$$DNL_{SingleDayFCLP} = 10\log_{10}\left[\sum_{i=1}^{N_{Day}} 10^{\frac{L_{Aeq,i}}{10}} + \sum_{j=1}^{N_{Night}} 10^{\frac{L_{Aeq,i}+10}{10}}\right] - 10\log_{10}(T_d) \qquad (7)$$

where

- $DNL_{SingleDayFCLP}$ is the DNL for the day due to FCLP activity
- N_{Day} is the number of 1-second A-weighted sound level measurements that occur during acoustic day (07:00 to 22:00) and during an FCLP period
- $L_{Aeq,i}$ is the 1-second A-weighted sound level measurement
- N_{Night} is the number of 1-second A-weighted sound level measurements that occur during acoustic night (22:00 to 07:00) and during an FCLP period
- T_d is 86,400 seconds (the number of seconds in 24 hours)

Note that the 1-second A-weighted sound level during acoustic night is adjusted by 10 dBA. This method uses the 1-second A-weighted sound level recorded by the sound level meter instead of formulating the DNL from aircraft noise event metrics.

The DNL for FCLP activity during the monitoring period is calculated as the energy average DNL across all seven days. This calculation follows equation (2), shown above in the Section 4.1.2 (page 44).

For completeness, the DNL for FCLP activity is combined with the DNL due to aircraft noise events (to account for flight operations to and from Ault Field). However, the FCLP operations were the major contributor to the DNL value at the sites around OLF Coupeville.

The Excel workbooks used to perform the data analysis for OLF Coupeville are included as part of the real-time measured results in the publicly available data (see Section 1.5).

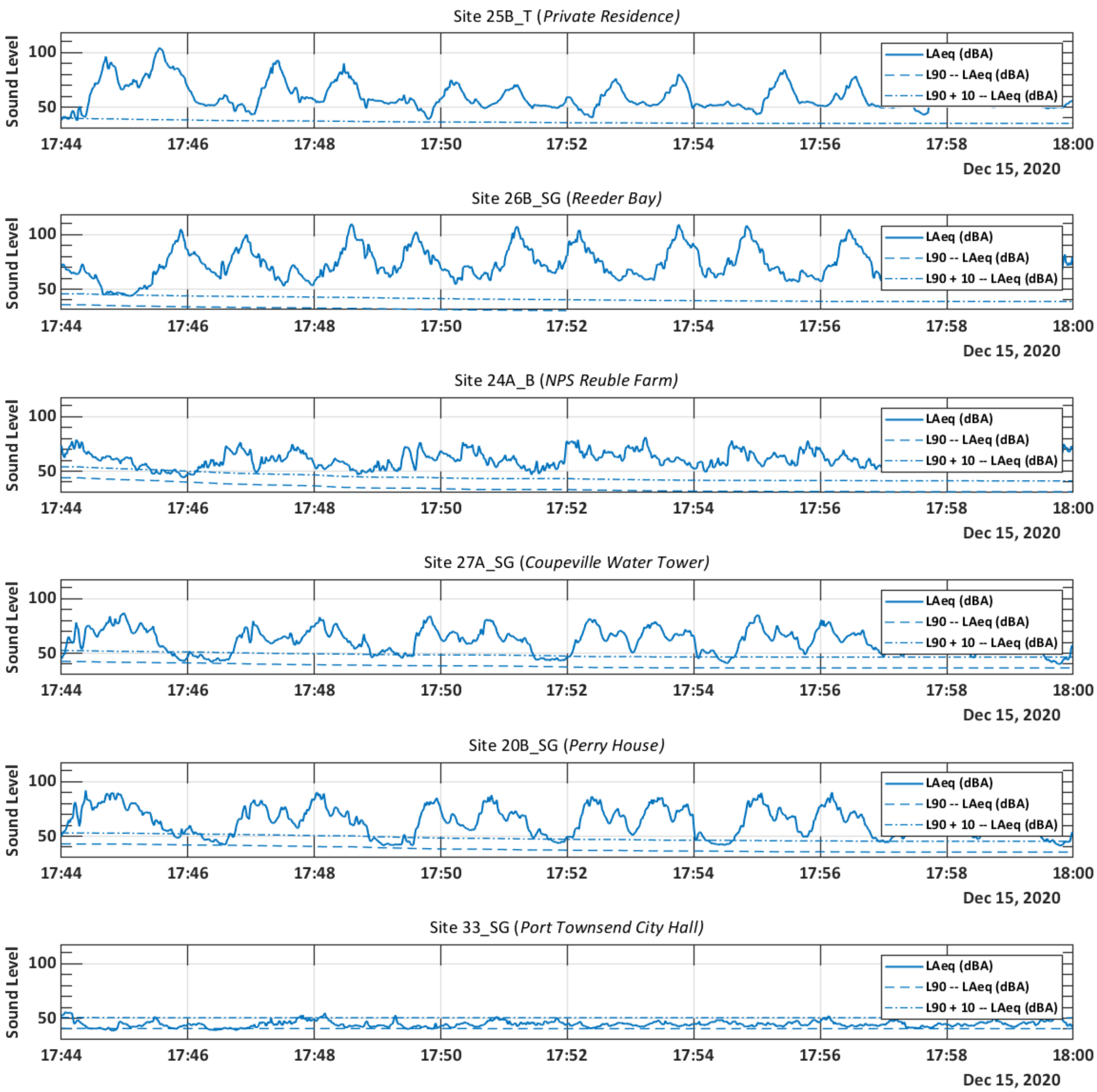


Figure 33. Example of Measured Sound Levels for FCLP Operation at OLF Coupeville

4.3 Olympic MOA Training Airspace Analysis

The acoustic data collected at the monitoring site near the Olympic MOA, Site 99_HOH (*Hoh Rain Forest Visitor Center*), were different because of the sporadic nature of the training events and because the training flights in that area do not perform regular, consistent patterns within the airspace. The flights are transient and at higher altitudes. Therefore, the acoustic analysis process was different. The process involved calculating DNL values during periods when the Olympic MOA was active and calculating $L_{Aeq,24hr}$ during periods when the MOA was not active. Thus, the process did not include direct identification of unique aircraft noise events. Additionally, part of this process removed non-aircraft mechanical noise events from both active and inactive time periods. The resulting monthly DNL and $L_{Aeq,24hr}$ values were compared to assess aircraft noise influence on the overall sound environment.

Two sets of figures are shown below. The first set serves as an example of non-aircraft mechanical noise while the second set is an example of aircraft noise. The non-aircraft mechanical noise events were visually identified and flagged for removal. These example figures illustrate that non-aircraft noise events are visually different from aircraft noise events.

An example of non-aircraft mechanical noise events is shown in Figure 34 (page 49) and Figure 35 (page 49). Figure 34 shows the sound level at Site 99_HOH (*Hoh Rain Forest Visitor Center*) in the afternoon of 13 October 2021; the five highlighted regions are separate noise events identified through the event detection process (see Section 4.1.1). All five noise events are attributed to non-aircraft mechanical noise. The ***real-time measured data*** for non-aircraft mechanical noise was not included in the calculation of DNL and $L_{Aeq,24hr}$ for the training airspace analysis.

Figure 35 shows a spectrogram of the soundscape during the same time period. The spectrogram places frequency on the Y-axis, and the sound level for a specific frequency is represented as a heatmap. The spectrogram, by breaking sound into its frequency components, allows the observer to distinguish between sound elements. The non-aircraft mechanical noise shown in the spectrogram includes loud impulsive sounds coupled with tonal noise. This pattern of non-aircraft mechanical noise was regularly observed in the ***real-time measured data***. The most likely source of this non-aircraft mechanical noise is a garbage truck emptying a trash dumpster near the monitoring site.

An example of an aircraft noise event is shown in Figure 36 (page 50) and Figure 37 (page 50). Figure 36 shows the sound level at Site 99_HOH (*Hoh Rain Forest Visitor Center*) in the morning of 04 October 2021; the single highlighted region is a noise event identified through the event detection process (see Section 4.1.1). The noise event is an aircraft noise event, and noise events like this example were included in the calculation of the DNL and $L_{Aeq,24hr}$ for the training airspace analysis.

Figure 37 shows a spectrogram of the soundscape during the same time period. This noise event is a potential aircraft noise event because it shows signs of broadband noise for frequencies below 1,000 hertz (Hz). Aircraft noise events typically contain broadband noise because the sound energy from the source is distributed over a large section of the audible range.

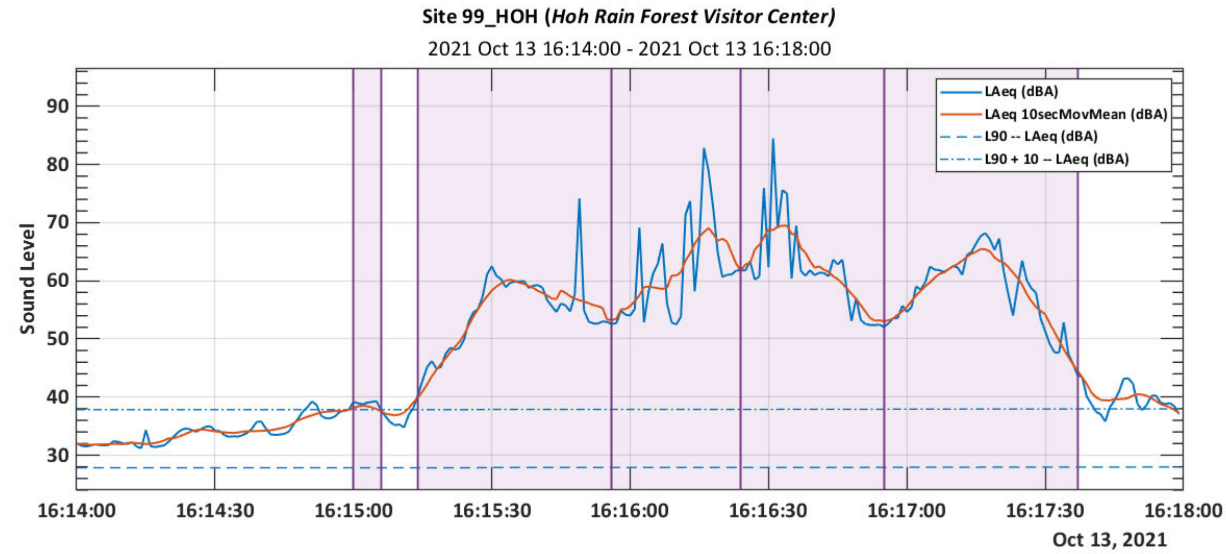


Figure 34. Sound Level and Identified Non-Aircraft Noise Events *Not* Included in the Calculation of Cumulative Metrics at Site 99_HOH (*Hoh Rain Forest Visitor Center*)

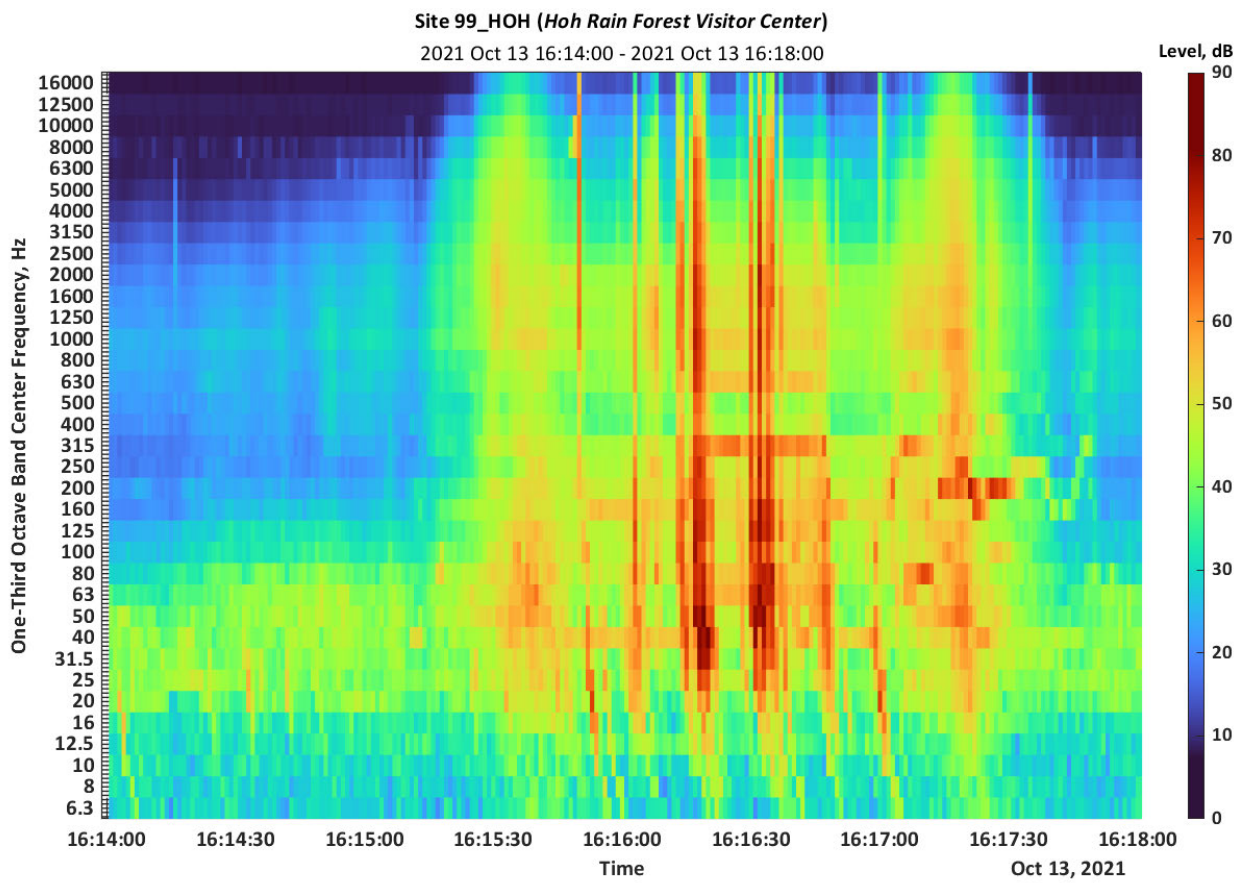


Figure 35. Spectrogram of Identified Non-Aircraft Noise Events *Not* Included in the Calculation of Cumulative Metrics at Site 99_HOH (*Hoh Rain Forest Visitor Center*)

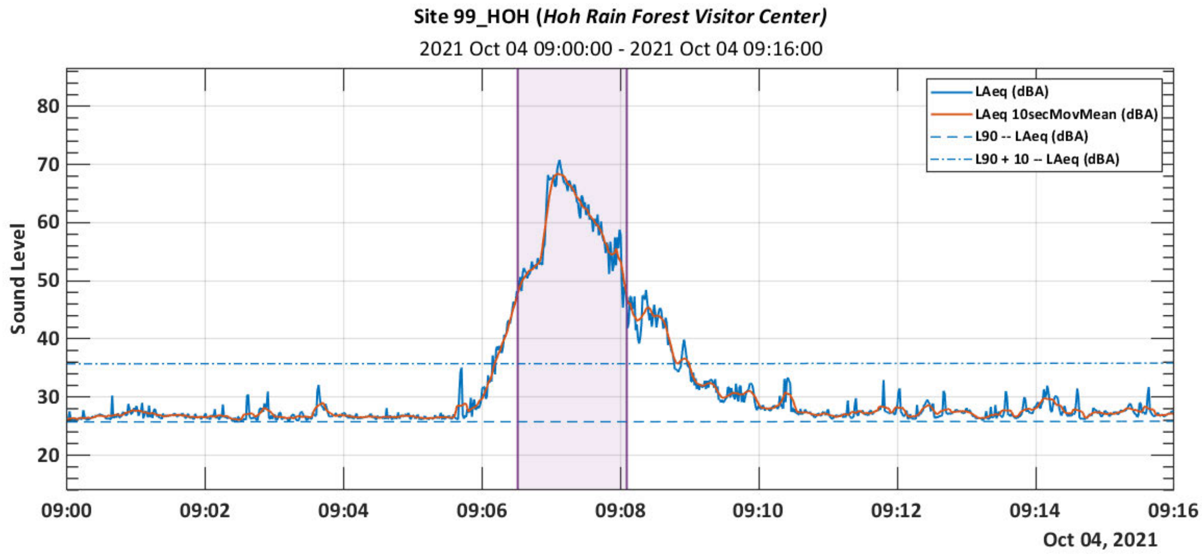


Figure 36. Sound Level and Identified Aircraft Noise Event Included in the Calculation of Cumulative Metrics at Site 99_HOH (*Hoh Rain Forest Visitor Center*)

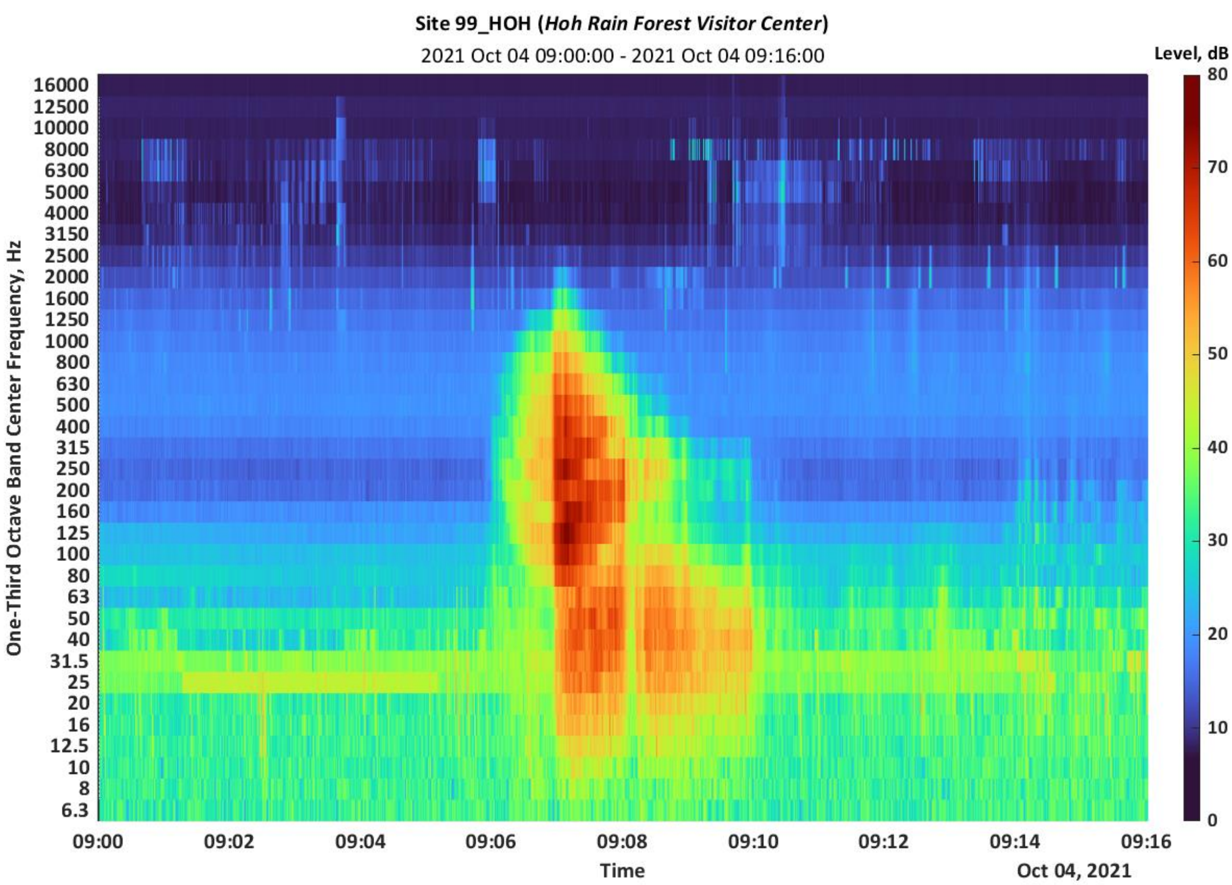


Figure 37. Spectrogram of Identified Aircraft Noise Events Included in the Calculation of Cumulative Metrics at Site 99_HOH (*Hoh Rain Forest Visitor Center*)

4.4 Comparing Measured Data to Modeled Results

For the two airfields, the monitoring team used the ***real-time flight operations data*** collected during the sound monitoring effort and compared it against two noise modeling scenarios: (1) modeling done specifically for this study using the observed flight operations data and (2) modeling completed as part of previous impact assessments at the two Navy installations. Based on these two comparisons, the monitoring team assessed the accuracy of the NOISEMAP models.

For the NOISEMAP modeling comparisons, the ***real-time acoustic data*** were merged with the ***real-time flight operations data***, as described in Section 4.1.1. The merged data are referred to in this report as ***real-time measured data***. The ***real-time measured data*** is used to calculate the real-time measured DNL and CNEL (see Section 4.1.2)

To assess the accuracy of the DoD aircraft noise-modeling tool, NOISEMAP, the monitoring team input actual operations data from the monitoring periods into the NOISEMAP model. The results of this modeling are referred to in this report as ***real-time modeled results***. The ***real-time measured data*** were compared to the ***real-time modeled results*** to test the accuracy of the NOISEMAP model based on the same operational parameters and flight activity observed during the monitoring periods.

To determine if previously modeled noise contours from prior impact assessments at NAS Whidbey Island and NAS Lemoore accurately predicted noise levels, the monitoring team compared the prior modeling results to the ***real-time measured data***. The data from prior modeling are referred to in this report as ***previously modeled results***. The ***previously modeled results*** were based on the NOISEMAP predictions associated with the Growler EIS [2] for NAS Whidbey Island and the F-35C West Coast Homebasing EIS [3] for NAS Lemoore. The comparison of the ***real-time measured data*** with the ***previously modeled results*** allowed the monitoring team to determine if ***previously modeled results*** for each installation accurately predicted noise levels during periods of operational activity.

For Site 99_HOH (*Hoh Rain Forest Visitor Center*), the acoustic and operations data were compared to the MRNMAP modeled results from the Northwest Training and Testing SEIS/OEIS [4]. The MRNMAP model is used for activities that occur in a defined area but do not have well-defined flight tracks such as those that occur at airfields. MRNMAP was used in this instance because the flights in Olympic MOA do not conform to patterns. The aircraft are transient, fly at higher altitudes, and use irregular flight tracks.

4.4.1 Calculating Sound Metrics

The real-time modeled DNL or CNEL used in the comparison is built from the ***real-time modeled results*** for each monitoring period. The real-time modeled DNL or CNEL is calculated as an energy average across all four monitoring periods in the same way that the real-time measured DNL or CNEL is calculated as an energy average across all four monitoring periods (see Section 4.1.2, equations (3) and (6) respectively).

5 AIRCRAFT NOISE RESULTS AND COMPARISONS

The Navy compared the ***real-time modeled results*** and the ***previously modeled results*** to the ***real-time measured data*** for the airfields at both installations and determined that the noise model operates as intended and provides an accurate prediction of sound levels from aircraft operations.

Due to the noise propagation assumption built into NOISEMAP, the model predicts the higher end of expected received sound level [6]. In addition, other operational factors contributed to overprediction during this study. The observed differences are within the Navy's expectations. This is discussed in more detail in the subsections below.

The Navy compared sound levels at the Olympic MOA when the area was both active and inactive to assess the aircraft noise contribution to overall sound levels. This comparison indicated that the aircraft sound levels do not contribute significantly to the overall sound levels at Site 99_HOH (*Hoh Rain Forest Visitor Center*), which is consistent with the analysis contained in the Northwest Training and Testing SEIS/OEIS [4].

The detailed comparative results are provided in Section 5.1 for NAS Whidbey Island, Section 5.2 for NAS Lemoore, and Section 5.3 for the Olympic MOA.

5.1 NAS Whidbey Island

5.1.1 Comparison of DNL Between Real-Time Measured Data and Modeled Results

Figure 38 shows a comparison of the ***real-time measured data*** and modeled results for both the real-time and previously modeled scenarios at NAS Whidbey Island. The figure provides three DNL values for each site: real-time modeled (yellow), previously modeled (gray), and real-time measured (blue). These DNL values are based on the energy average of the DNLs from all four monitoring periods (see Section 4.1.2). The comparison indicates that the model operates as intended and provides an accurate prediction of sound levels from aircraft operations. The figure shows that the real-time measured DNL is usually less than the real-time modeled and previously modeled DNL from NOISEMAP. The largest differences between measured and modeled data occurred at sites not directly overflown by Navy aircraft. The Navy expected this finding based on the model's conservative prediction assumptions [6]. Other differences between measured and modeled data were due to variation in ground cover, sortie rates, and a lower number of flights during acoustic night.

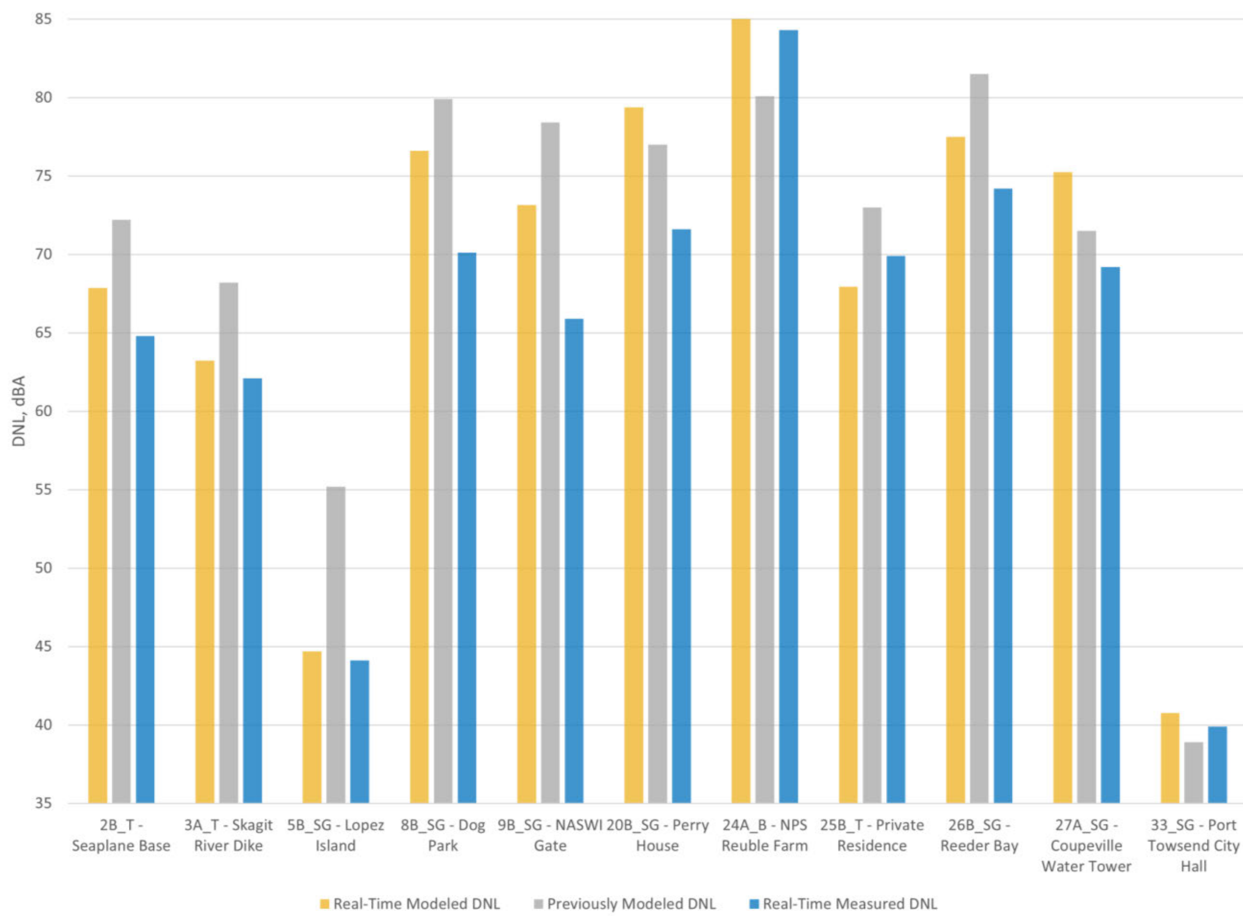


Figure 38. DNL Comparison Between the Modeled Results and Measured Data

Table 11 and Table 12 provide the DNL values associated with Figure 38. Details on the differences between modeled and measured data are provided below.

Comparison of DNL Between Real-Time Modeled and Real-Time Measured

Table 11 compares ***real-time modeled results*** and the ***real-time measured data***. A positive difference in DNL indicates NOISEMAP predicted higher DNL values, while a negative difference in DNL indicates NOISEMAP predicted lower DNL values.

The real-time measured DNL for Site 27A_SG (*Coupeville Water Tower*) was reported as 69.0 dBA in the Real-Time Aircraft Sound Monitoring Report to Congress [7]. A review of the calculations for real-time measured DNL found that the 10 dBA adjustment for nighttime activities was not applied to FCLPs on the night of 07 June 2021, at Site 27A_SG (*Coupeville Water Tower*) only. This correction resulted in the real-time measured DNL changing from 69.0 to 69.2 dBA. All of the other real-time measured DNL calculations were correct.

Table 11. Comparisons Between the Real-Time Modeled and Real-Time Measured DNL for All Monitoring Periods at NAS Whidbey Island

Site ID and Name	Real-Time Modeled DNL (dBA)	Real-Time Measured DNL (dBA)	Difference Between Modeled and Measured DNL (dBA)
2B_T – Seaplane Base	67.9	64.8	3.1
3A_T – Skagit River Dike	63.2	62.1	1.1
5B_SG – Lopez Island	44.7	44.1	0.6
8B_SG – Dog Park	76.6	70.1	6.5
9B_SG – NASWI Gate	73.1	65.9	7.2
20B_SG – Perry House	79.4	71.6	7.8
24A_B – NPS Reuble Farm	85.1	84.3	0.8
25B_T – Private Residence	67.9	69.9	-2.0
26B_SG – Reeder Bay	77.5	74.2	3.3
27A_SG – Coupeville Water Tower	75.2	[a]69.2	6.0
33_SG – Port Townsend City Hall[b]	40.8	39.9	0.9

Key: dBA = A-weighted decibels; DNL = day-night average sound level; FCLP = field carrier landing practice; NAS = Naval Air Station; NASWI = NAS Whidbey Island
Notes: Shading in the table matches the color scheme in the legend of Figure 38.
[a] Change from Real-Time Aircraft Sound Monitoring Report to Congress [7]. Modified from 69.0 to 69.2 dBA DNL.
[b] While the Port Townsend City Hall meter location is away from the airfield, it is located near an arrival and departure flight track.

From the comparison of the ***real-time modeled results*** and ***real-time measured data***, the average difference in DNL was +3.2 dBA, with only Site 25B_T (*Private Residence*) showing a negative difference in DNL of -2.0 dBA. The largest difference at Ault Field occurred at Site 9B_SG (*NASWI Gate*), which is not directly overflown. The largest differences at OLF Coupeville occurred at Site 20B_SG (*Perry House*) and Site 27A_SG (*Coupeville Water Tower*), which are inside the FCLP turn for landing on Runway 32 at OLF Coupeville.

Effect of Direct Aircraft Overflights at Site 25B_T (*Private Residence*)

As shown in Figure 39, Site 25B_T (*Private Residence*) lies approximately 700 (wide track), 1,600 (center track), and to 2,600 (narrow track) feet outside of the modeled turns to downwind for the FCLP pattern on OLF Runway 14. However, during the first monitoring period when FCLPs were flown on OLF Runway 14, aircraft were observed to be directly overhead of the monitoring site. These small variations are expected with normal flight track dispersion. A direct overflight from an aircraft on the wide flight track would lead to a 3 dBA increase in the expected received SEL. These wider flights would contribute to a slight increase in the measured DNL values compared to the modeled results.

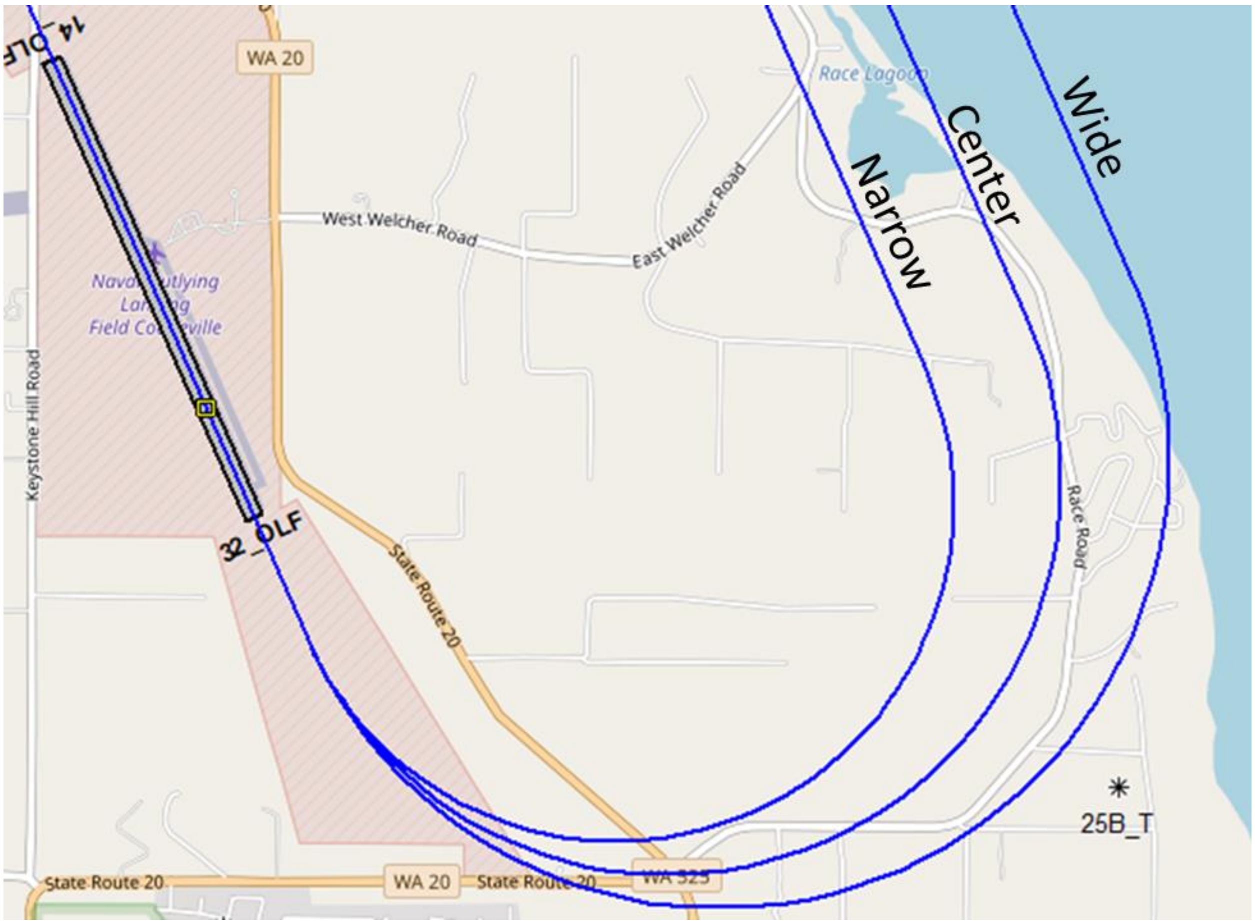


Figure 39. Location of Site 25B_T (*Private Residence*) Relative to the Modeled FCLP Tracks for Runway 14 at OLF Coupeville

Effect of Vegetation at Site 9B_SG (*NASWI Gate*) and Site 20B_SG (*Perry House*)

Site 9B_SG (*NASWI Gate*) and Site 20B_SG (*Perry House*) were not directly overflown by the flight operations, and the ground between them and closest point of approach of nearby flights is wooded. The extra attenuation from the stand of trees is not included in NOISEMAP's prediction algorithms (see Appendix B.5). Thus, the modeled DNL values are higher compared to the measured values.

Comparison of DNL Between Previously Modeled and Real-time Measured

Table 12 is based on the comparison between *previously modeled results* and the *real-time measured data*. A positive difference in DNL indicates NOISEMAP predicted higher DNL values, while a negative difference in DNL indicates NOISEMAP predicted lower DNL values.

Table 12. Comparisons Between the Previously Modeled and Real-Time Measured DNL for All Monitoring Periods at NAS Whidbey Island

Site ID and Name	Previously Modeled[a] DNL (dBA)	Real-Time Measured DNL (dBA)	Difference Between Modeled and Measured DNL (dBA)
2B_T – Seaplane Base	72.2	64.8	7.4
3A_T – Skagit River Dike	68.2	62.1	6.1
5B_SG – Lopez Island	55.2	44.1	11.1
8B_SG – Dog Park	79.9	70.1	9.8
9B_SG – NASWI Gate	78.4	65.9	12.5
20B_SG – Perry House	77.0	71.6	5.4
24A_B – NPS Reuble Farm	80.1	84.3	-4.2
25B_T – Private Residence	73.0	69.9	3.1
26B_SG – Reeder Bay	81.5	74.2	7.3
27A_SG – Coupeville Water Tower	71.5	[b]69.2	2.3
33_SG – Port Townsend City Hall[c]	38.9	39.9	-1.0

Key: dBA = A-weighted decibels; DNL = day-night average sound level; FCLP = field carrier landing practice; NAS = Naval Air Station; NASWI = NAS Whidbey Island; NPS = National Park Service

Notes: Shading in the table matches the color scheme in the legend of Figure 38.

[a] Previously modeled values are from the Growler EIS [2].

[b] Change from Real-Time Aircraft Sound Monitoring Report to Congress [7]. Modified from 69.0 to 69.2 dBA DNL

[c] While the Port Townsend City Hall meter location is away from the airfield, it is located near an arrival and departure flight track.

From the comparison of *previously modeled results* and *real-time measured data*, the average difference in DNL was +5.4 dBA, with Site 24A_B (*NPS Reuble Farm*) showing a negative difference in DNL of -4.2 dBA. The largest difference of +12.5 dBA occurred at Site 9B_SG (*NASWI Gate*), which is behind the departures on Runway 14 at Ault Field.

The following discussion provides details on the differences in the DNL. The discussion distinguished between Ault Field and OLF Coupeville monitoring sites.

The Ault Field monitoring sites are:

- Site 2B_T (*Seaplane Base*)
- Site 3A_T (*Skagit River Dike*)
- Site 5B_SG (*Lopez Island*)
- Site 8B_SG (*Dog Park*)
- Site 9B_SG (*NASWI Gate*)

The OLF Coupeville monitoring sites are:

- Site 20B_SG (*Perry House*)
- Site 24A_B (*NPS Reuble Farm*)
- Site 25B_T (*Private Residence*)
- Site 26B_SG (*Reeder Bay*)
- Site 27A_SG (*Coupeville Water Tower*)
- Site 33_SG (*Port Townsend City Hall*)

Effect of Percentage of Acoustic Nighttime Operations at Ault Field and OLF Coupeville Monitoring Sites

The overprediction for Ault Field and OLF Coupeville monitoring sites is due in part to the EA-18G's percentage of acoustic nighttime operations. The EA-18G's previously modeled percentage of acoustic nighttime operations at Ault Field was 12 percent, and at OLF Coupeville, it was 20 percent. The real-time flight operations had less acoustic nighttime operations, with Ault Field at 5 percent and OLF Coupeville at 18 percent. This lower percentage of acoustic nighttime operations contribute to an expected lower value for the real-time measured DNL.

Effect of Sortie Rate at Ault Field and OLF Coupeville Monitoring Sites

The overprediction for Ault Field monitoring sites is due in part to the sortie rate[2] of the EA-18G. The EA-18G's previously modeled sortie rate was 49.741, while the real-time sortie rate was 30.143. Thus, the real-time sortie rate was 39 percent less than previously modeled, leading to an expected lower value for the real-time measured DNL (the expansion of EA-18G flight operations at NAS Whidbey Island is still underway).

The measurement periods for this study were scheduled to coincide with planned FCLP activity at OLF Coupeville, which resulted in higher FCLP flight activity in the ***real-time flight operations data*** compared to the previously modeled flight operations data, which is based on an average annual day. Measurement periods needed to include FCLP activity because FCLP's are the largest contributor to the DNL at OLF Coupeville monitoring sites. The previously modeled sortie rate was 28.445 FCLP patterns on an average annual day basis, as described in Appendix B.3 [5], while the observed real-time sortie rate was 49.356 patterns per monitored day. Thus, the real-time sortie rate for FCLP activity was 74 percent greater than previously modeled.

Effect of Flight Track Utilization at OLF Coupeville Monitoring Sites

Field observations noted two differences in flight track utilization at OLF Coupeville compared to the flight track utilization defined in the Growler EIS [2]:

- The addition of a new flight track for both OLF Runway 14 and OLF Runway 32
- Flight track utilization percentage

The previous model included three flight tracks each for OLF Runway 14 and OLF Runway 32; these flight tracks are designated as narrow, center, and wide. The narrow track has the smallest abeam distance between the runway and the downwind leg while the wide track has the largest abeam distance. Field observations identified a short flight track that was not included in the previous model. Figure 40 (page 60) shows the short flight track (red) in relation to the modeled

[2] Sortie rate is defined as the average number of flight operations per day.

narrow flight track (blue) for OLF Runway 14, and Figure 41 (page 61) shows the same comparison but for the flight tracks out of OLF Runway 32. The short flight tracks are characterized by a shorter and tighter ascending turn into the downwind leg of the FCLP compared to the other modeled flight tracks. These two tracks and associated flight profiles were added to the real-time modeled NOISEMAP case since they are outside of normal flight track dispersion.

When the short track was flown for OLF Runway 14, the slant distance between the aircraft and the monitoring site is longer for Site 20B_SG (*Perry House*), Site 25B_T (*Private Residence*), and Site 27A_G (*Coupeville Water Tower*). When the short track was flown for OLF Runway 32, the slant distance between the aircraft and the monitoring site is longer for Site 24A_B (*NPS Reuble Farm*) and Site 26B_SG (*Reeder Bay*). The longer slant distance leads to the lower sound levels observed at these monitoring sites; thus, a lower real-time measured DNL is expected.

Field observations showed that the short tracks for OLF Runway 14 and OLF Runway 32 were most often utilized when there are one or two aircraft in the FCLP pattern. When three or four aircraft are in the FCLP pattern, the flights are spread out to maintain proper spacing, and the previously modeled narrow, center, and wide flight tracks are used.

The addition of the new tracks at OLF Coupeville leads to a change in the flight track utilization distribution. The ***previously modeled results*** used a distribution among narrow, center, and wide tracks to account for variability in the track over the ground. The center track was modeled at 50 percent of the FCLPs with the narrow and wide tracks at 25 percent each. However, field observations showed that the short and narrow flight tracks were utilized for 81 percent of FCLP flight operations.

The observed utilization rates for these tracks are 20 percent for the short track, 61 percent for the narrow track, 13 percent for the center track, and 6 percent for the wide track. The higher use of the short and narrow flight tracks resulted in real-time measured and modeled DNL values being higher on the inner track and lower from the center track outward compared to the Growler EIS [2].

As noted in the Growler EIS, although flight tracks are represented as single lines on maps, they actually depict the predominant path aircraft fly over the ground. The actual path of an aircraft over the ground is affected by aircraft performance, pilot technique, ATC instruction, other air traffic, noise abatement procedures and weather conditions [2].

The key point is that the flight track is the predominant path the aircraft follows, but some dispersion in the flight track is expected. The amount of dispersion may result in an aircraft operating left or right of the modeled flight tracks.

NOISEMAP does not consider flight track dispersion when modeling aircraft noise at an airfield. The effect of flight track dispersion on the estimated DNL can be reduced for certain closed pattern flight operations by modeling multiple flight tracks. Thus, FCLP flight operations at OLF Coupeville are modeled with multiple tracks that vary by the distance between the downwind leg and the runway.

Since the short track was not in the *previously modeled results*, a comparison was performed to evaluate the effect of the observed short track and FCLP flight track utilization differences on the *previously modeled results*. This evaluation considered the changes in the modeled DNL at the OLF Coupeville monitoring sites by revising the previously modeled flight track utilization to 20 percent for the added short track, 61 percent for the narrow track, 13 percent for the center track, and 6 percent for the wide track. Table 13 shows the results of this comparison. The largest increase of +1.3 dBA occurred at Site 24A_B (*NPS Reuble Farm*) and Site 27A_G (*Coupeville Water Tower*). These sites were the closest to the short and narrow tracks and demonstrated higher DNL values because of the higher flight track utilization for these tracks. The largest decrease of -3.9 dBA occurred at Site 25B_T (*Private Residence*), which was outside of the modeled wide patten. This resulted in lower DNL value because the aircraft operated farther away from the site. The differences shown in Table 13 indicate that the observed noise levels were slightly higher than previously modeled for areas near the upwind turn and downwind leg of the narrow pattern, and noise levels were lower for areas outside of the wide pattern. Areas inside of the final turn were similar.

Table 13. Comparisons Between the Previously Modeled DNL and the DNL Using the Revised Flight Track Utilization Distribution at NAS Whidbey Island

Site ID and Name	DNL Using Revised Flight Track Utilization (dBA)	Previously Modeled [a] DNL (dBA)	Difference Between Revised and Modeled DNL (dBA)
20B_SG – Perry House	77.1	77.0[b]	0.1
24A_B – NPS Reuble Farm	81.4	80.1	1.3
25B_T – Private Residence	69.1	73.0	-3.9
26B_SG – Reeder Bay	80.4	81.5	-1.1
27A_SG – Coupeville Water Tower	72.8	71.5	1.3
33_SG – Port Townsend City Hall	38.7	38.9	-0.2

Key: NAS = Naval Air Station; DNL = day-night average sound level
Note: Shading in the table matches the color scheme in the legend of Figure 38
[a] Previously modeled values are from the Growler EIS [2]

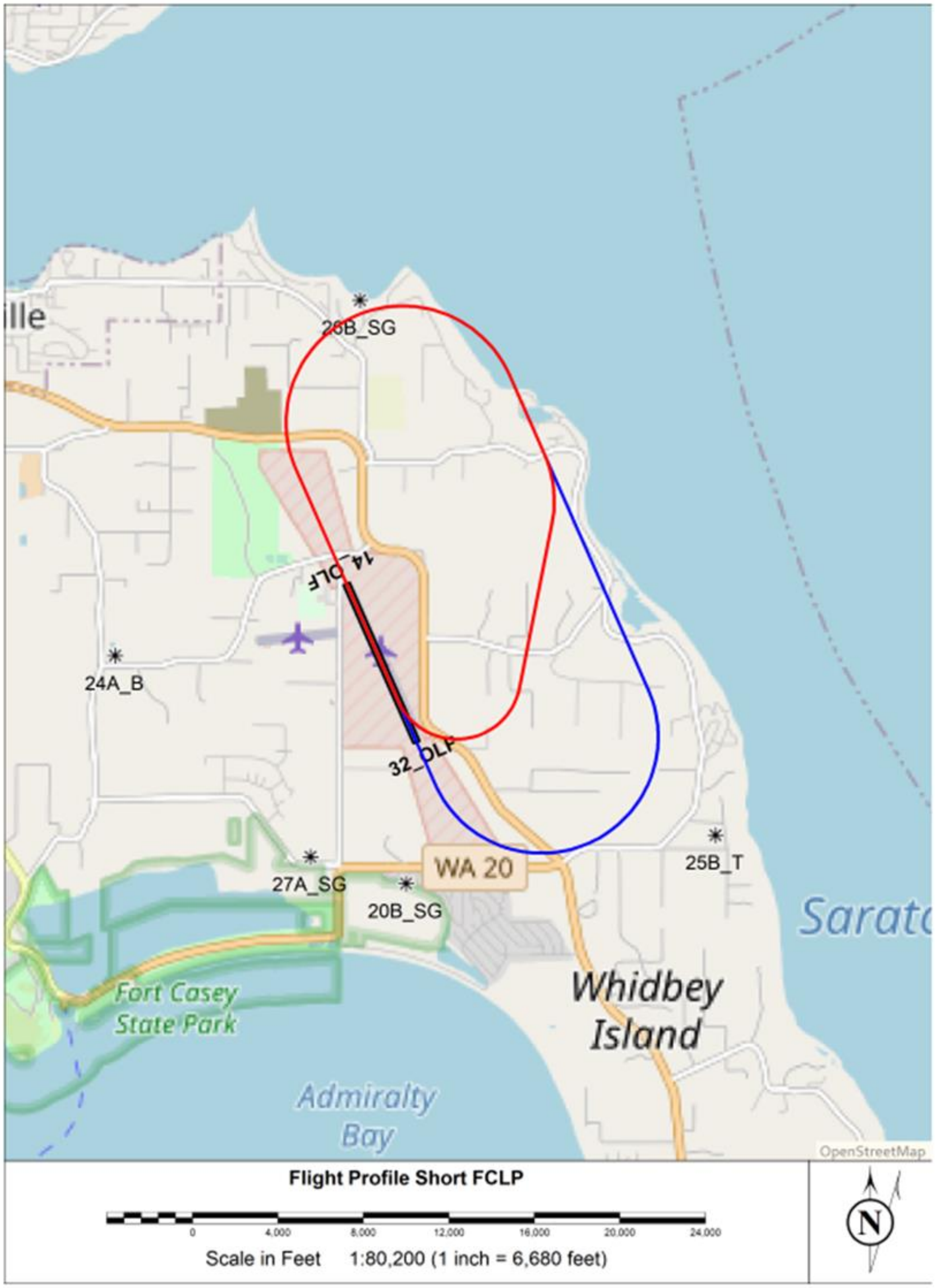


Figure 40. Short FCLP Pattern Observed on OLF Runway 14

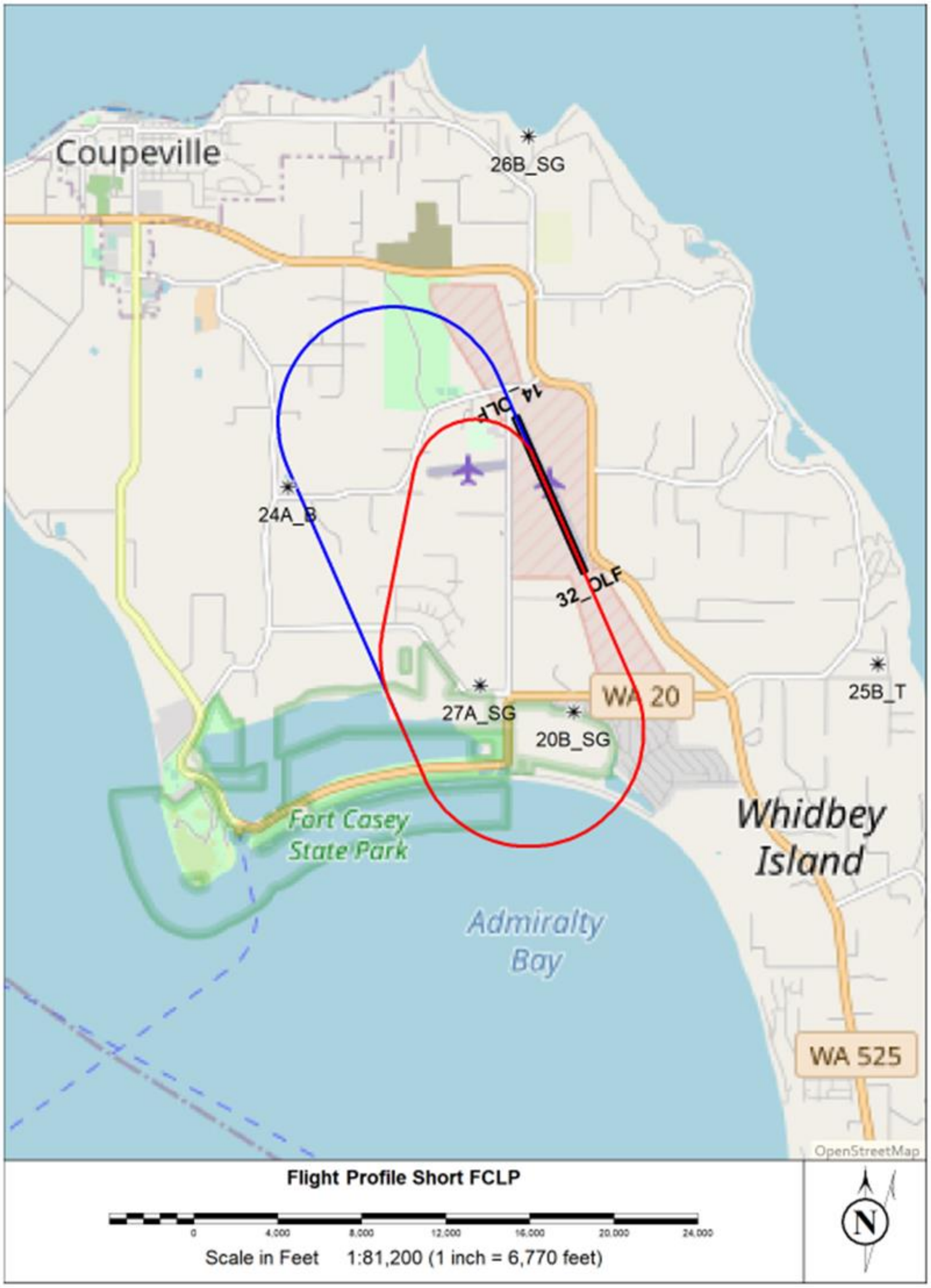


Figure 41. Short FCLP Pattern Observed on OLF Runway 32

Effect of Direct Aircraft Overflights at Site 24A_B (*NPS Reuble Farm*)

Site 24A_B (*NPS Reuble Farm*) is the only OLF Coupeville monitoring site directly overflown when FCLPs use OLF Runway 32. OLF Runway 32 was the sole runway utilized during the March 2021, June 2021, and August 2021 monitoring periods. The higher use of the narrow and short flight tracks, as previously described, resulted in more direct overflights of a monitoring site. The higher occurrence of these direct overflights resulted in higher real-time DNL value.

Effect of Vegetation at Site 9B_SG (*NASWI Gate*) and Site 20B_SG (*Perry House*)

As stated previously, NOISEMAP does not include additional attenuation from vegetation, thus the modeled DNL is expected to be greater than the real-time measured DNL at Site 9B_SG (*NASWI Gate*) and Site 20B_SG (*Perry House*).

Real-Time DNL Calculation for Site 33_SG (Port Townsend City Hall)

The real-time measured DNL and real-time modeled DNL for Site 33_SG (*Port Townsend City Hall*) was calculated using only data from the March 2021, June 2021, and August 2021 monitoring periods. Data from the December 2020 monitoring period was not included in the DNL calculation because the local wind speed at the monitoring site regularly exceeded 5 meters per second (approximately 11 miles per hour).

Wind effects were minimized by protecting the microphone with a windscreen; however, the windscreen does not provide adequate protection against wind-induced noise on the microphone diaphragm at high wind speeds. Boersma showed that the background ambient sound level grows with the wind speed [12]. The higher background sound level impedes the aircraft noise event identification process, defined in Section 4.1.1, because the process does not account for local wind speed when classifying an event as an aircraft noise event. Thus, to limit the effect of wind noise on the DNL, the aircraft noise events identified during the December 2020 monitoring period were not included.

5.1.2 Review of Noise Event Classification and its Effect on Real-Time Measured DNL

The majority of real-time flight operations were correlated with a noise event, and these aircraft noise events were used to calculate the real-time measured DNL. However, due to the automated methodology for classifying noise events (see Section 4.1.1), there were some true aircraft noise events that were misclassified as non-aircraft noise events. A comparison exercise was performed to determine the effect on the real-time measured DNL of misclassifying a true aircraft noise event as a non-aircraft noise event. This exercise is important because it demonstrates that the noise event classification methods were sufficient.

For this exercise, all noise events identified through the event detection process (see Section 4.1.1) were treated as aircraft noise events, and a new real-time measured DNL was calculated; this value was labeled as the all-events measured DNL (DNL_{AE}). A comparison of the real-time modeled DNL and the all-events measured DNL_{AE} is shown in Figure 42. Site 5B_SG (*Lopez Island*) and Site 33_SG (*Port Townsend City Hall*) were not included in this comparison because the all-events measured DNL_{AE} was below 60 dBA. This comparison assumed that aircraft noise is the dominant sound source at sites with an all-events measured DNL_{AE} greater than 60 dBA, thus allowing for more direct comparison to the real-time modeled DNL.

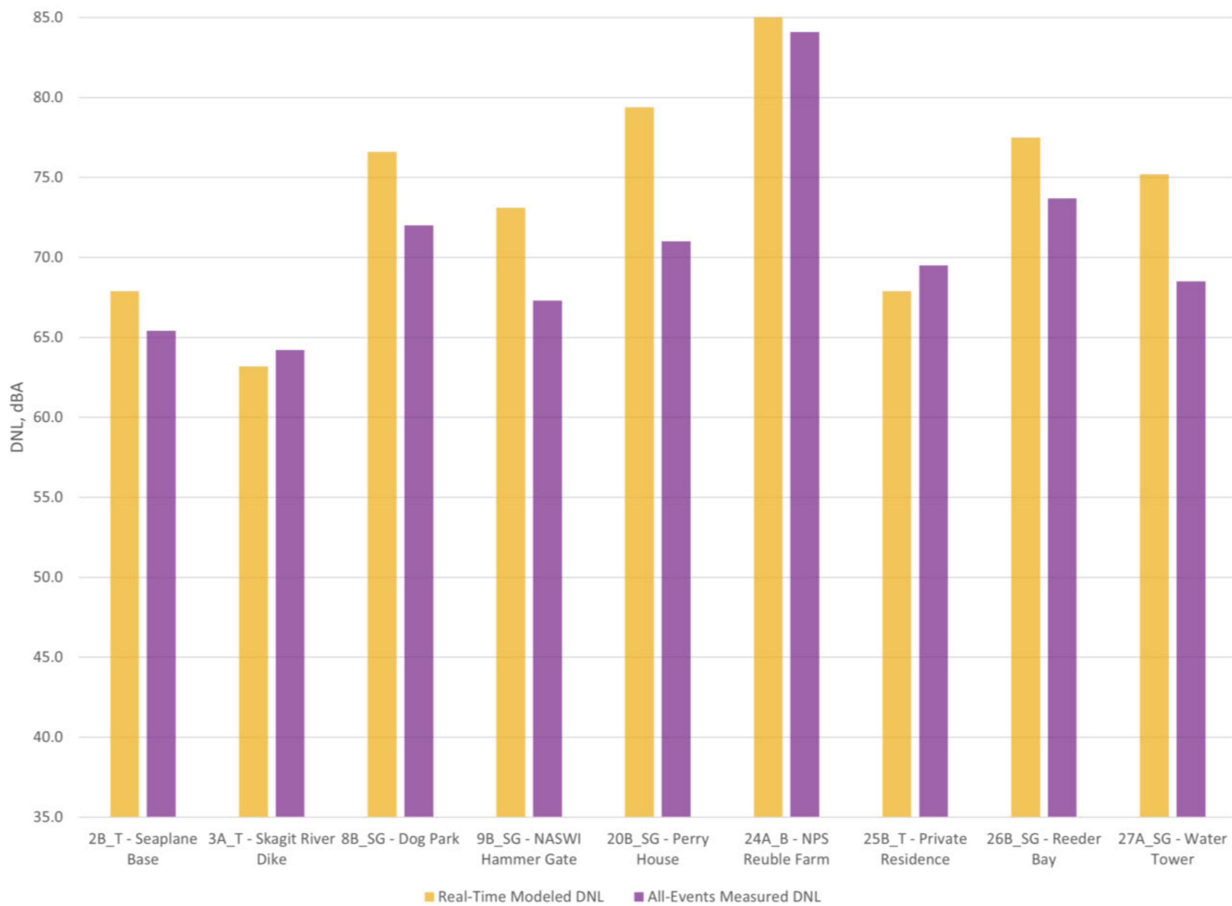


Figure 42. DNL Comparison Between the Modeled DNL and Measured DNL_{AE}

Table 14 provides the DNL values associated with Figure 42. For Table 14, a positive difference in DNL indicates NOISEMAP predicted higher DNL values when all noise events were included, while a negative difference in DNL indicated NOISEMAP predicted lower DNL values when all noise events were included.

Table 14. Comparisons Between the Real-Time Modeled and Real-Time Measured DNLAE for All Monitoring Periods at NAS Whidbey Island

Site ID and Name	Real-Time Modeled DNL (dBA)	All-Events Measured DNLAE (dBA)	Difference Between Modeled and Measured DNLAE (dBA)
2B_T – Seaplane Base	67.9	65.4	2.5
3A_T – Skagit River Dike	63.2	64.2	-1.0
8B_SG – Dog Park	76.6	72.0	4.6
9B_SG – NASWI Gate	73.1	67.3	5.8
20B_SG – Perry House	79.4	71.0	8.4
24A_B – NPS Reuble Farm	85.1	84.1	1.0
25B_T – Private Residence	67.9	69.5	-1.6
26B_SG – Reeder Bay	77.5	73.7	3.8
27A_SG – Coupeville Water Tower	75.2	68.5	6.7

Key: DNL = day-night average sound level; DNLAE = all events measured DNL; NAS = Naval Air Station; NASWI = NAS Whidbey Island; NPS = National Park Service

Note: Shading in the table matches the color scheme in the legend of Figure 42.

From the comparison of the ***real-time modeled results*** and the ***real-time measured data***, the average difference in DNL, with all noise events included, was +3.4 dBA. Hence, this comparison exercise provides additional support for the primary conclusion of this technical report.

The majority of results from the monitoring sites included in this comparison had a positive difference. The positive difference implies that even if a noise event failed to be accurately classified as an aircraft noise event, NOISEMAP would continue to predict the higher end of expected received sound level.

Results from only two monitoring sites showed a negative difference: Site 3A_T (*Skagit River Dike*) showed a difference of -1.0 dBA and Site 25B_T (*Private Residence*) showed a difference of -1.6 dBA. A review of the ***real-time measured data*** identified that additional sound sources contributed to the DNLAE at each site.

Site 3A_T (*Skagit River Dike*)

Figure 3, in Section 2.1.2, shows the monitoring site on the edge of the Skagit River. During the study, small gas-powered boats traveled up and down the river, generating noise events when they passed the monitoring site. The boat noise events contribute to the soundscape at Site 3A_T

(*Skagit River Dike*). They occurred often enough and with enough energy to significantly contribute to the all-events measured DNL_{AE} to a level greater than the real-time modeled DNL.

An example of boat noise events and aircraft noise events are shown in Figure 43 and Figure 44. Figure 43 shows the sound level at Site 3A_T (*Skagit River Dike*) on the morning of 15 December 2020; the four highlighted regions are four separate noise events identified through the event detection process (see Section 4.1.1). The noise events at 10:58 and 11:04 were attributed to gas-powered boats passing the monitoring site, while the noise events at 11:16 and 11:18 were aircraft noise events due to the pre-flight run-up and departure of an EA-18G Growler from Ault Field on Runway 7 at 11:16.

Figure 44 shows a spectrogram of the soundscape during the same period of time. The spectrogram places frequency on the Y-axis, and the sound level for a specific frequency is represented as a heat map. The spectrogram, by breaking sound into its frequency components, allows the observer to distinguish between sound elements. The two boat noise events show signs of mechanical noise because they have strong tonal components at 250 Hz and 500 Hz. The two aircraft noise events show signs of broadband noise for frequencies below 1,000 Hz; the events contain broadband noise because the sound energy from the source is distributed over a large section of the audible range.

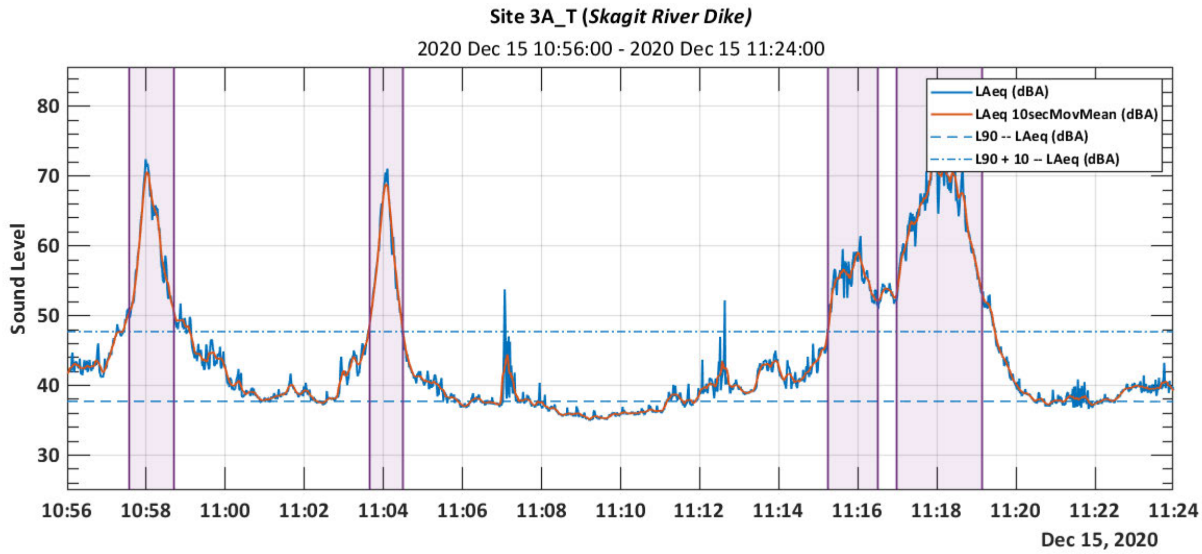


Figure 43. Sound Level and Identified Noise Events at Site 3A_T (*Skagit River Dike*)

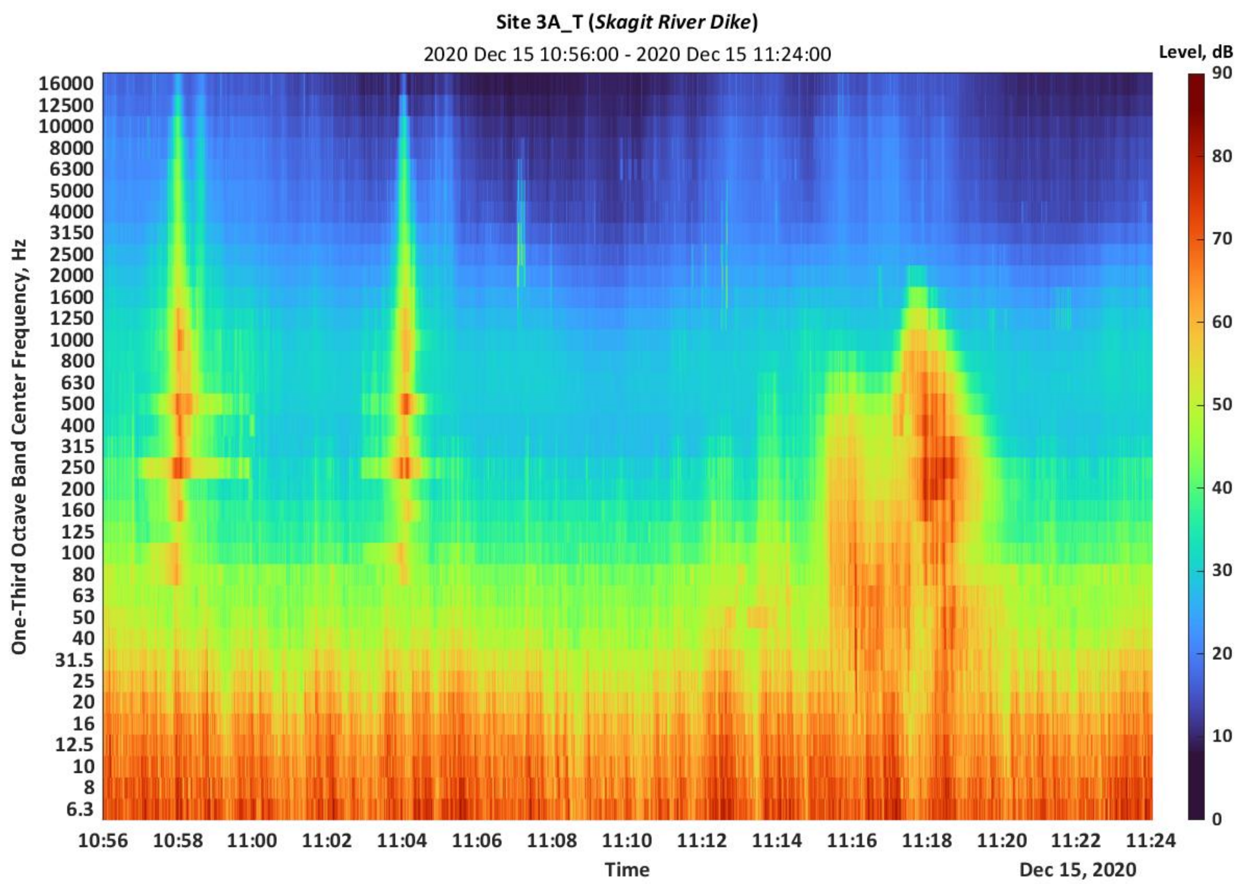


Figure 44. Spectrogram of the Soundscape at Site 3A_T (*Skagit River Dike*)

Site 25B_T (*Private Residence*)

Two primary factors at Site 25B_T (*Private Residence*) contributed to the all-events measured DNL_{AE} to a level greater than the real-time modeled DNL. The first was the direct overflights of FCLPs during the December 2020 monitoring period. Aircraft were observed flying wider than the modeled flight track and directly overflew the residence. The effect of these few direct overflights is discussed above. The second factor was non-aircraft tonal noise during the March 2021 monitoring period.

An example of tonal noise events is shown in Figure 45 and Figure 46. Figure 45 shows the sound level at Site 25B_T (*Private Residence*) in the evening of 30 March 2021. The highlighted areas of the graph represent separate noise events identified through the noise detection process (see Section 4.1.1). All noise events were attributed to a non-aircraft tonal source. Multiple events were identified because the sound level is not constant. The transient nature caused several peaks to form during the time period when the sound level was above L_{90} + 10 dBA. These peaks are considered separate noise events.

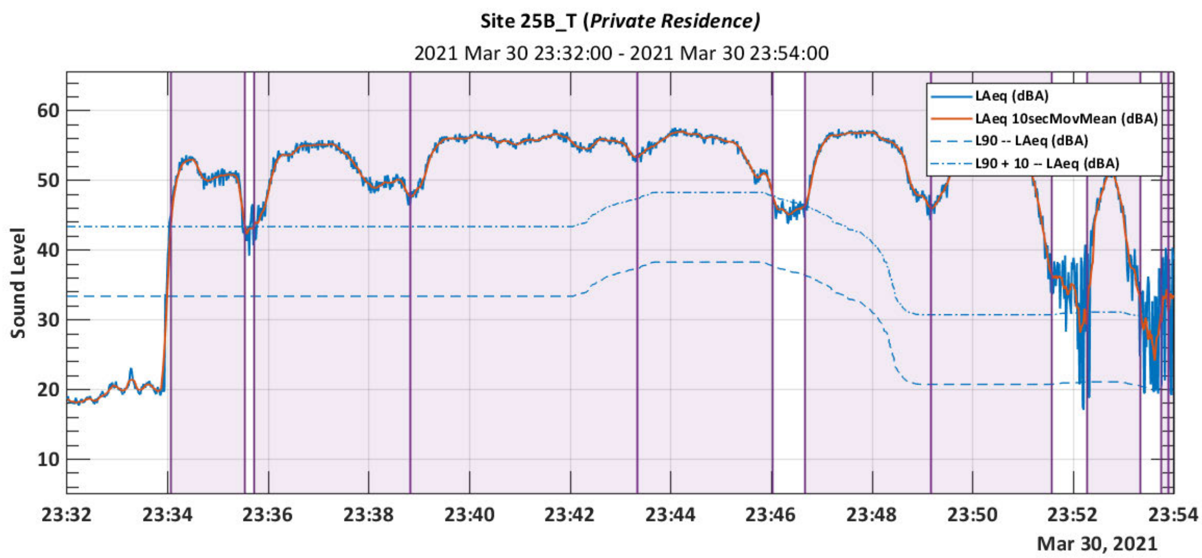


Figure 45. Sound Level and Identified Noise Events at Site 25B_T (*Private Residence*)

Figure 46 shows a spectrogram of the soundscape during the same time period. The noise events had strong tonal components at 1,000 Hz and 2,000 Hz. These tonal components occur at higher frequencies than those seen in broadband aircraft noise. This type of frequency content is usually attributed to insect activity.

The effect of the tonal sound source was estimated by calculating a DNL_{AE} from an A-weighted sound level adjusted to diminish the energy present in the 1,000-Hz to 2,500-Hz range. The adjustment was applied by linearly interpolating the frequency components of the ***real-time measured data*** from 800 Hz to 3,150 Hz. Figure 47 shows the result of this linear interpolation. The interpolation is evident because the sound level at 2,000 Hz is reduced from 60 dB to 28 dB and a smooth transition from 800 Hz to 3,150 Hz is now present.

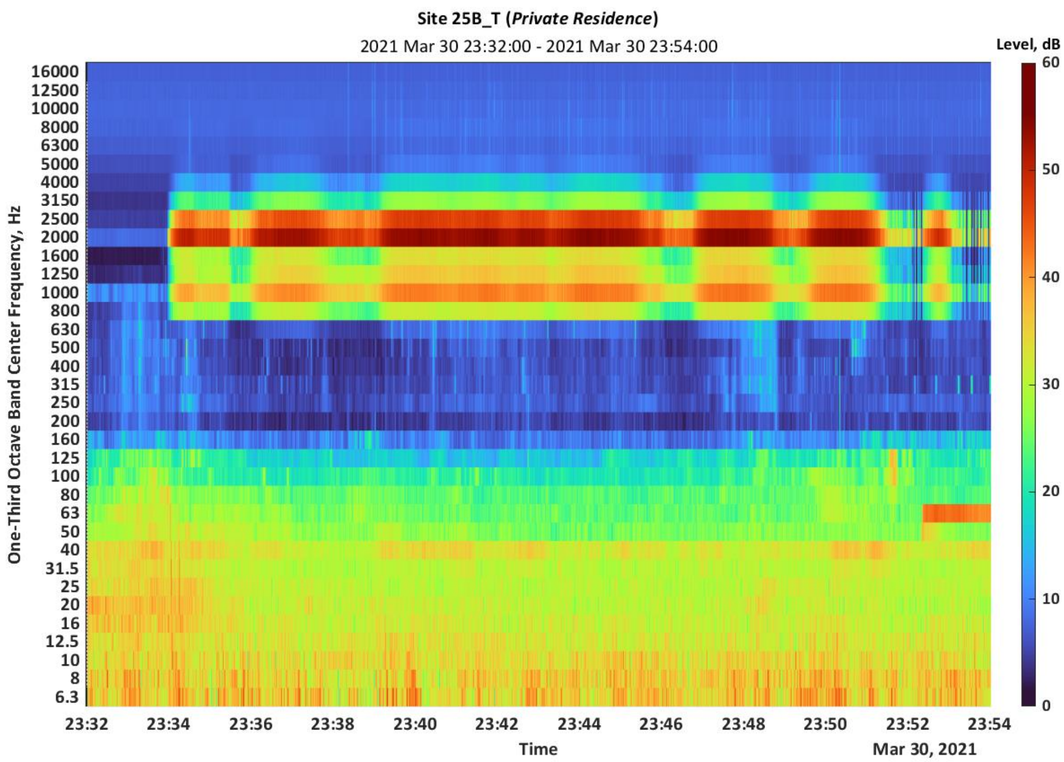


Figure 46. Spectrogram of the Soundscape at Site 25B_T (*Private Residence*)

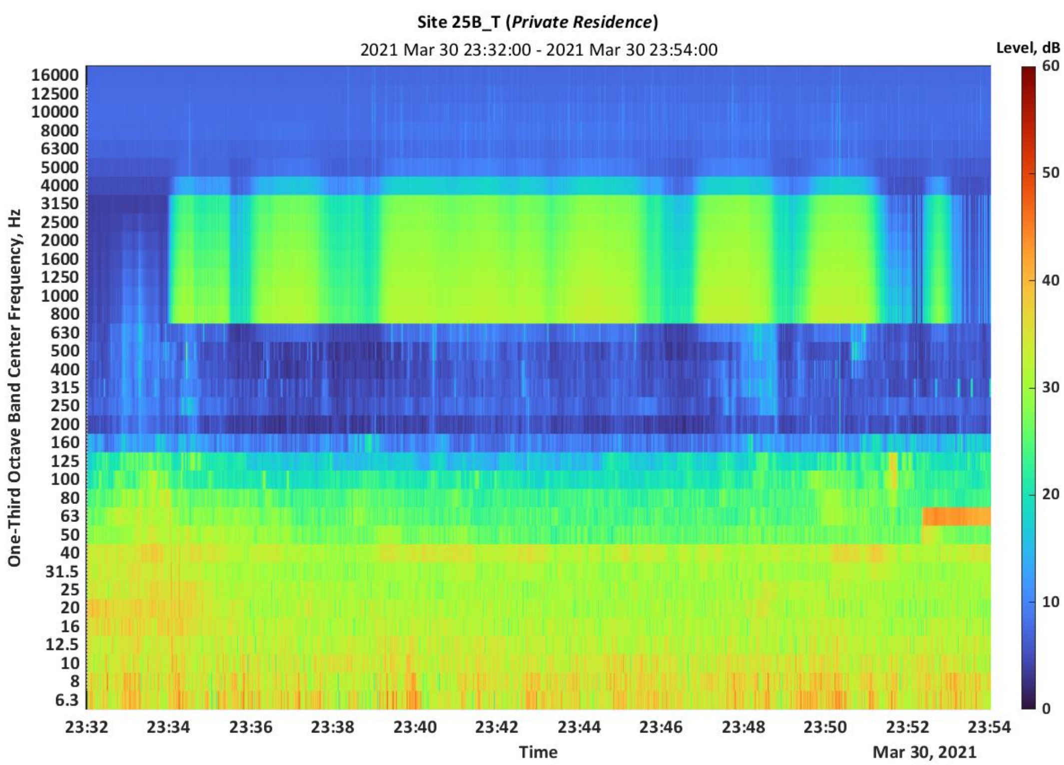


Figure 47. Spectrogram of the Soundscape at Site 25B_T (*Private Residence*) with Linear Interpolation of Sound Energy from 800 Hz to 3,150 Hz

All frequency components, including the interpolated values, were then used to calculate an adjusted A-weighted sound level. This adjusted sound level was used to calculate estimated SELs for each noise event, which in turn were used to calculate an estimated DNL_{AE}.

The DNL_{AE} for the March 2021 monitoring period was 57.5 dBA, and the estimated DNL_{AE} was 50.8 dBA. The 6.7 dBA reduction in DNL is due to the diminished effect of the non-aircraft tonal noise.

5.2 NAS Lemoore

5.2.1 Comparison of CNEL Between Real-Time Measured Data and Modeled Results

Figure 48 shows a comparison of the measured and modeled data for both the real-time and previously modeled scenarios at NAS Lemoore. The figure provides three CNEL values for each site: real-time modeled (yellow), previously modeled (gray), and real-time measured (blue). These CNEL values are based on the energy average of the CNELs from all four monitoring periods (see Section 4.1.2). The comparison indicates that the model operated as intended and provided an accurate prediction of sound levels from aircraft operations. The figure shows that the real-time measured CNEL is usually less than the real-time modeled and previously modeled CNEL from NOISEMAP. The largest differences between measured and modeled data occurred at sites not directly overflown by Navy aircraft. The Navy expected this finding based on the model's conservative prediction assumptions [6]. Other differences between the measured data and the modeled data were due to variation in ground cover, sorties rates, and lower number of flights during acoustic night.

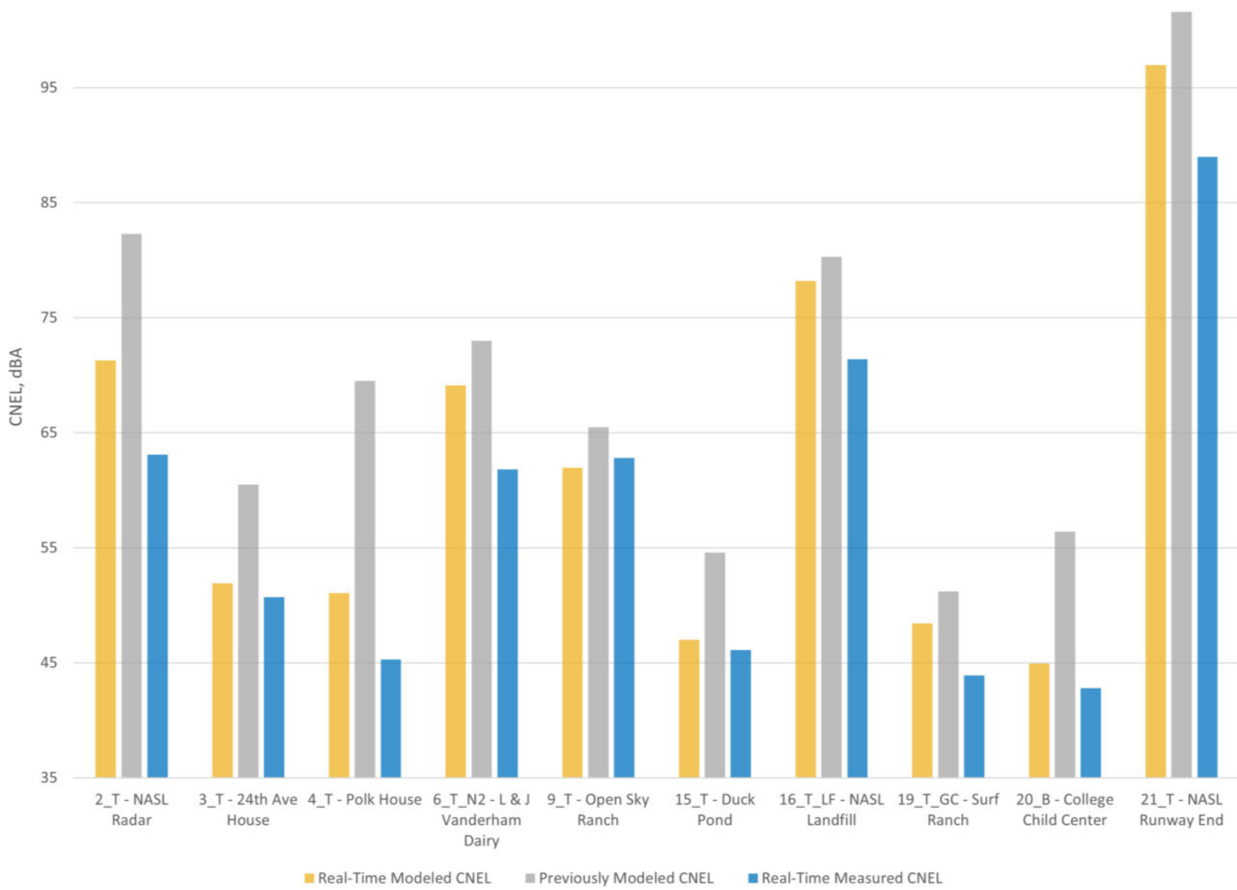


Figure 48. CNEL Comparison Between the Measured Data and Modeled Results

Table 15 and Table 16 provide the CNEL values associated with Figure 48. Details on the differences between modeled and measured data are provided below.

Comparison of CNEL Between Real-Time Modeled and Real-Time Measured

Results listed in Table 15 are based on the comparison between the *real-time measured data* and *real-time modeled results*. A positive difference in CNEL indicates NOISEMAP predicted higher CNEL values, while a negative difference in CNEL indicates NOISEMAP predicted lower CNEL values.

Table 15. Comparisons Between the Real-Time Modeled and Real-Time Measured CNEL for All Monitoring Periods at NAS Lemoore

Site ID and Name	Real-Time Modeled CNEL (dBA)	Real-Time Measured CNEL (dBA)	Difference Between Modeled and Measured CNEL (dBA)
2_T – NASL Radar	71.3	63.1	8.2
3_T – 24th Avenue House	51.9	50.7	1.2
4_T – Polk House	51.1	45.3	5.8
6_T_N2 – L & J Vanderham Dairy	69.1	61.8	7.3
9_T – Open Sky Ranch	61.9	62.8	-0.9
15_T – Duck Pond	47.0	46.1	0.9
16_T_LF – NASL Landfill	78.2	71.4	6.8
19_T_GC – Surf Ranch	48.4	43.9	4.5
20_B – College Child Center	44.9	42.8	2.1
21_T – NASL Runway End	97.0	89.0	8.0

Key: CNEL = community noise equivalent level; NAS = Naval Air Station; NASL = NAS Lemoore
Note: Shading in the table matches the color scheme in the legend of Figure 48.

From the comparison of the real-time modeled data and real-time measured results, the average difference in CNEL is +4.4 dBA, with only Site 9_T (*Open Sky Ranch*) showing a negative difference in CNEL of -0.9 dBA. The largest difference of +8.2 dBA occurred at Site 2_T (*NASL Radar*), which is underneath the downwind leg for patterns on Runway 32R at Reeves Field.

Effect of Vegetation on NAS Lemoore Monitoring Sites

The sites around the airfield, especially Site 2_T (*NASL Radar*), are surrounded by tilled farmland, which provides more ground attenuation than assumed in NOISEMAP's prediction algorithms. This type of ground cover results in lower measured noise levels compared to predicted levels (see Appendix B.5).

Comparison of CNEL Between Previously Modeled and Real-Time Measured

Table 16 shows a comparison of the *real-time measured data* and *previously modeled results*. A positive difference in CNEL indicates NOISEMAP predicted higher CNEL values, while a negative difference in CNEL indicates NOISEMAP predicted lower CNEL values.

Table 16. Comparison Between the Previously Modeled and Real-Time Measured CNEL for All Monitoring Periods at NAS Lemoore

Site ID and Name	Previously Modeled[a] CNEL (dBA)	Real-Time Measured CNEL (dBA)	Difference between Modeled and Measured CNEL (dBA)
2_T – NASL Radar	82.3	63.1	19.2
3_T – 24th Ave House	60.5	50.7	9.8
4_T – Polk House	69.5	45.3	24.2
6_T_N2 – L & J Vanderham Dairy	73.0	61.8	11.2
9_T – Open Sky Ranch	65.5	62.8	2.7
15_T – Duck Pond	54.6	46.1	8.5
16_T_LF – NASL Landfill	80.3	71.4	8.9
19_T_GC – Surf Ranch	51.2	43.9	7.3
20_B – College Child Center	56.4	42.8	13.6
21_T – NASL Runway End	101.6	89.0	12.6

Key: CNEL = community noise equivalent level; NAS = Naval Air Station; NASL = NAS Lemoore
Notes: Shading in the table matches the color scheme in the legend of Figure 48.
[a] Previously modeled values are from the F-35C West Coast Homebasing EIS [3].

From the comparison of previously modeled data and *real-time measured data*, the average difference in CNEL is +11.8 dBA, with no sites showing a negative difference in CNEL. The largest difference of +24.2 dBA occurred at Site 4_T (*Polk House*), which is laterally offset from most flight tracks at Reeves Field.

Effect of Percentage of Acoustic Evening and Nighttime Operations at NAS Lemoore Monitoring Sites

The overprediction for NAS Lemoore monitoring sites is due in part to the F/A-18E/F and F-35C's percentage of acoustic evening nighttime operations. The previously modeled percentage of acoustic evening and nighttime operations at NAS Lemoore was 21 percent and 11 percent, respectively. The real-time flight operations showed fewer acoustic evening and nighttime operations, with the evening operations at 14 percent and nighttime operations at 1 percent. The lower percentage of acoustic evening and nighttime operations contributes to an expected lower value for the real-time measured CNEL.

Effect of Sortie Rate at NAS Lemoore Monitoring Sites

The overprediction for NAS Lemoore monitoring sites is due in part to the sortie rate of the F-35C. The F-35C's previously modeled sortie rate was 39.737, while the real-time sortie rate was 10.658.

Thus, the real-time sortie rate was 73 percent less than previously modeled, contributing to an expected lower value for the real-time measured CNEL.

5.2.2 Review of Noise Event Classification and Its Effect on Real-Time Measured CNEL

The majority of real-time flight operations were correlated with a noise event, and these aircraft noise events were used to calculate the real-time measured CNEL. However, due to the automated methodology for classifying noise events (see Section 4.1.1), there were some true aircraft noise events that were misclassified as non-aircraft noise events. A comparison exercise was performed to determine the effect on the real-time measured CNEL from misclassifying a true aircraft noise event as a non-aircraft noise event. This exercise is important because it demonstrates that the noise event classification methods were sufficient.

For this exercise, all noise events identified through the event detection process (see Section 4.1.1) were treated as aircraft noise events, and a new real-time measured CNEL was calculated; this value was labeled as the all-events measured $CNEL_{AE}$. A comparison of the real-time modeled CNEL and the all-events measured $CNEL_{AE}$ is shown in Figure 42. The following monitoring sites are not included in this comparison:

- Site 3_T (*24th Avenue House*)
- Site 4_T (*Polk House*)
- Site 15_T (*Duck Pond*)
- Site 19_T_GC (*Surf Ranch*)
- Site 20_B (*College Child Center*)

The sites were not included because the all-events measured $CNEL_{AE}$ was below 60 dBA. This comparison assumed that aircraft noise was the dominant sound source at sites with an all-events measured $CNEL_{AE}$ greater than 60 dBA, thus allowing for more direct comparison to the real-time modeled CNEL.

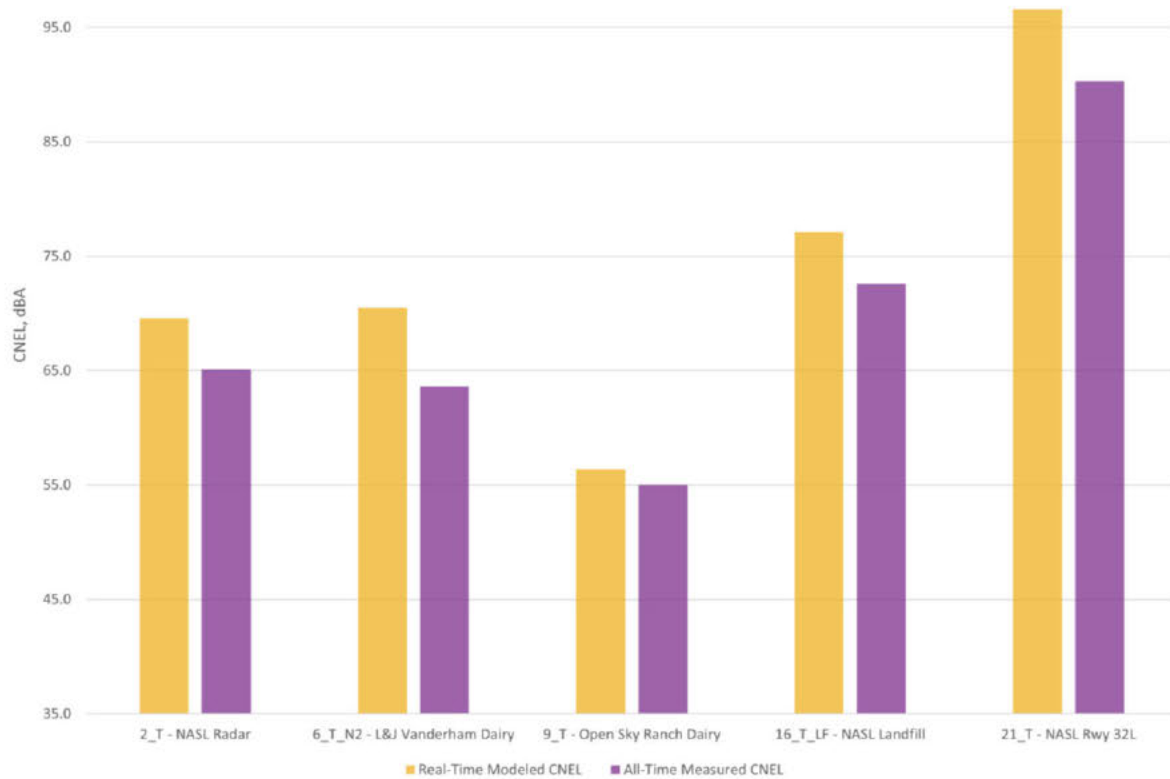


Figure 49. CNEL Comparison Between Modeled CNEL and Measured $CNEL_{AE}$

Table 17 provides the CNEL values associated with Figure 49. For Table 17, a positive difference in CNEL indicates NOISEMAP predicted higher CNEL values when all noise events were included, while a negative difference in CNEL indicates NOISEMAP predicted lower CNEL values when all noise events were included.

Table 17. Comparisons Between the Real-Time Modeled and Real-Time Measured $CNEL_{AE}$ for All Monitoring Periods at NAS Lemoore

Site ID and Name	Real-Time Modeled CNEL (dBA)	All-Events Measured $CNEL_{AE}$ (dBA)	Difference Between Modeled and Measured $CNEL_{AE}$ (dBA)
2_T – NASL Radar	71.3	65.7	5.6
6_T_N2 – L & J Vanderham Dairy	69.1	53.7	5.4
9_T – Open Sky Ranch	61.9	65.3	-3.4
16_T_LF – NASL Landfill	78.2	73.5	4.7
21_T – NASL Runway End	97.0	90.8	6.2

Key: CNEL = community noise equivalent level; $CNEL_{AE}$ = all-events measured CNEL; NAS = Naval Air Station; NASL = NAS Lemoore

Note: Shading in the table matches the color scheme in the legend of Figure 49.

From the comparison of the ***real-time modeled results*** and the ***real-time measured data***, the average difference in CNEL, with all noise events included, was +3.7 dBA. Hence, this comparison exercise provides additional support for the primary conclusion of this technical report.

Results from the majority of monitoring sites included in this comparison had a positive difference. A positive difference implies that even if a noise event failed to be accurately classified as an aircraft noise event, NOISEMAP would continue to predict the higher end of expected received sound level. Results from only one monitoring site showed a negative difference: Site 9_T (*Open Sky Ranch Dairy*) showed a difference of -3.4 dBA. A review of the ***real-time measured data*** identified that additional sound sources contributed to the $CNEL_{AE}$ at this site.

Site 9_T (*Open Sky Ranch Dairy*)

Figure 18, in Section 2.1.2, shows the monitoring site on the edge of a field on Open Sky Ranch Dairy property; the observer is facing west for both images. Figure 50 shows an agricultural building approximately 350 feet east of the monitoring site. This building is home to the milk storage facility for the dairy farm, and the industrial equipment housed in this facility produces consistent broadband noise that contributes the CNEL at this site.

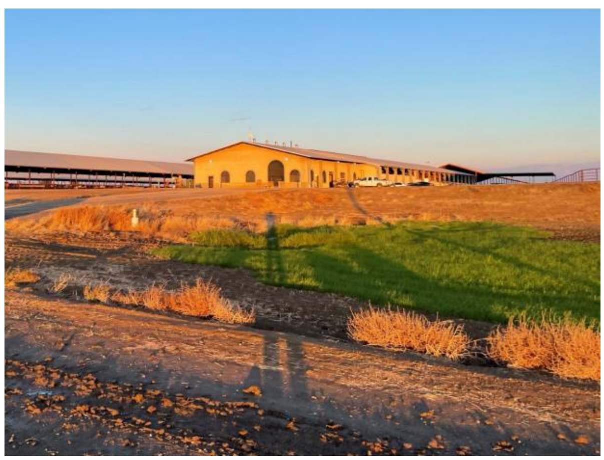


Figure 50. Agricultural Building at Site 9_T (*Open Sky Ranch Dairy*)

Figure 51 shows the sound level at Site 9_T (*Open Sky Ranch Dairy*) in the early morning of 29 January 2021. This figure helps illustrate the noise produced by the industrial equipment housed in the milk storage facility. The sound level exhibited a step change around 00:22, decreasing by more than 10 dBA, when the equipment momentarily shuts off. The two noise events shown were attributed to the industrial equipment; these noise events occurred because the equipment shuts off, and the sound level drops below the detection threshold.

Figure 52 shows a spectrogram of the soundscape during the same period of time. The spectrogram places frequency on the Y-axis, and the sound level for a specific frequency is represented as a heat map. The spectrogram, by breaking sound into its frequency components, allows the observer to distinguish between sound elements. The industrial equipment is characterized by broadband noise below 4,000 Hz; when the equipment shuts off around 00:22, the broadband noise was eliminated and only the natural soundscape was left.

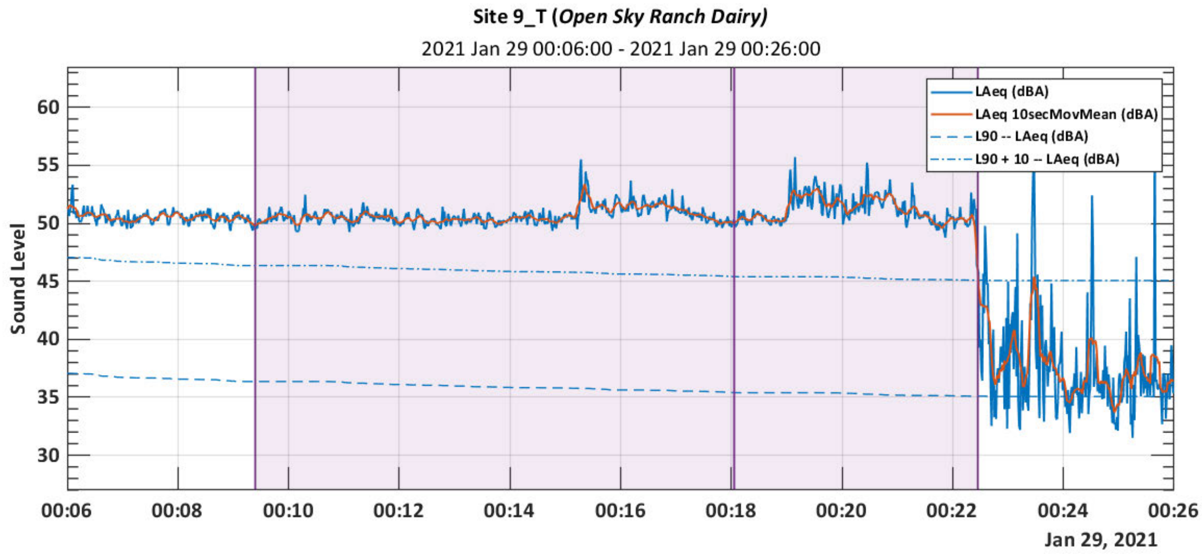


Figure 51. Sound Level and Identified Noise Events at Site 9_T (*Open Sky Ranch Dairy*)

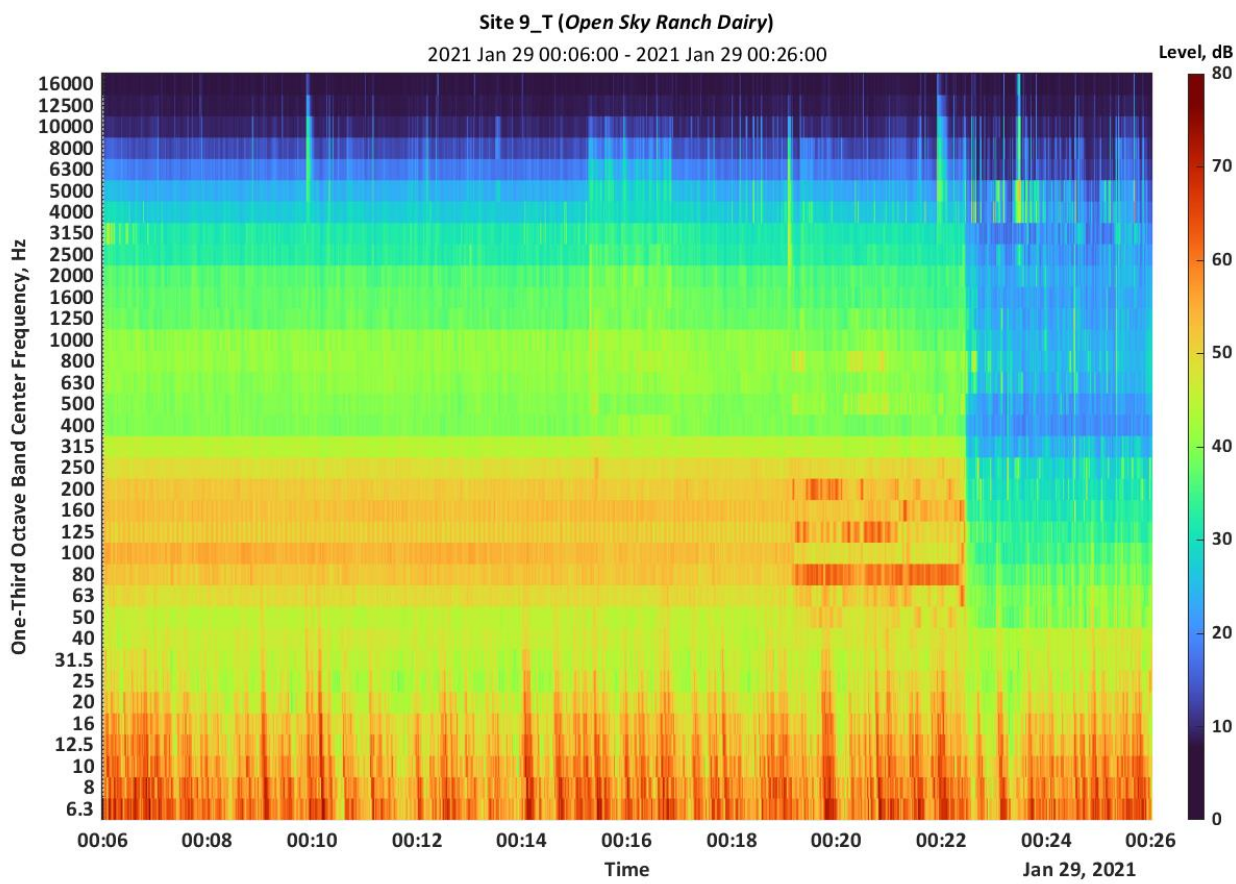


Figure 52. Spectrogram of the Soundscape at Site 9_T (*Open Sky Ranch Dairy*)

5.3 Olympic MOA

5.3.1 Comparison of Noise Exposure Between Active and Inactive Use of Olympic MOA

The acoustic data collected at Site 99_HOH (*Hoh Rain Forest Visitor Center*) involved a yearlong data collection period. The process involved measuring sound levels when the Olympic MOA was active and inactive. When the MOA was active, the monitoring site had the potential to receive noise from military aircraft; however, the site was not guaranteed to receive aircraft noise due to the sporadic nature of training events and because the training flights do not perform regular patterns within the airspace. Additionally, atmospheric conditions could have influenced the propagation of the aircraft noise (see Appendix A.3). Thus, the analysis only considers sound exposure levels between active and inactive periods to assess the potential aircraft noise contribution to the overall sound levels. The aircraft noise exposures at the MOA monitoring site were below average sound levels from other sources, most of which were natural, so the Navy was unable to do a direct comparison of measured and modeled aircraft sound exposure levels.

Instead, the comparison involves average sound exposure levels during periods when the MOA was active and inactive. It does not indicate when aircraft were audible at the site. Audibility of a sound source is a different acoustic measure that is not included in this analysis.

Figure 53 shows the comparison of the measured monthly DNL sound levels when the MOA was active (had the potential to receive military aircraft noise) to the measured $L_{Aeq,24hr}$ when the MOA was inactive (mostly received natural sounds or sounds of non-military aircraft flyovers). This approach is described in Section 4.3. The results of this comparison highlight the low sound exposure levels measured at this site. The average sound exposure levels for both active and inactive time periods, for most months, were between 35 and 45 dBA. Only 1 month (April 2021) had average exposure levels above 45 dBA when the MOA was active. Three months (March, July, and August) had average exposure levels below 35 dBA when the MOA was active.

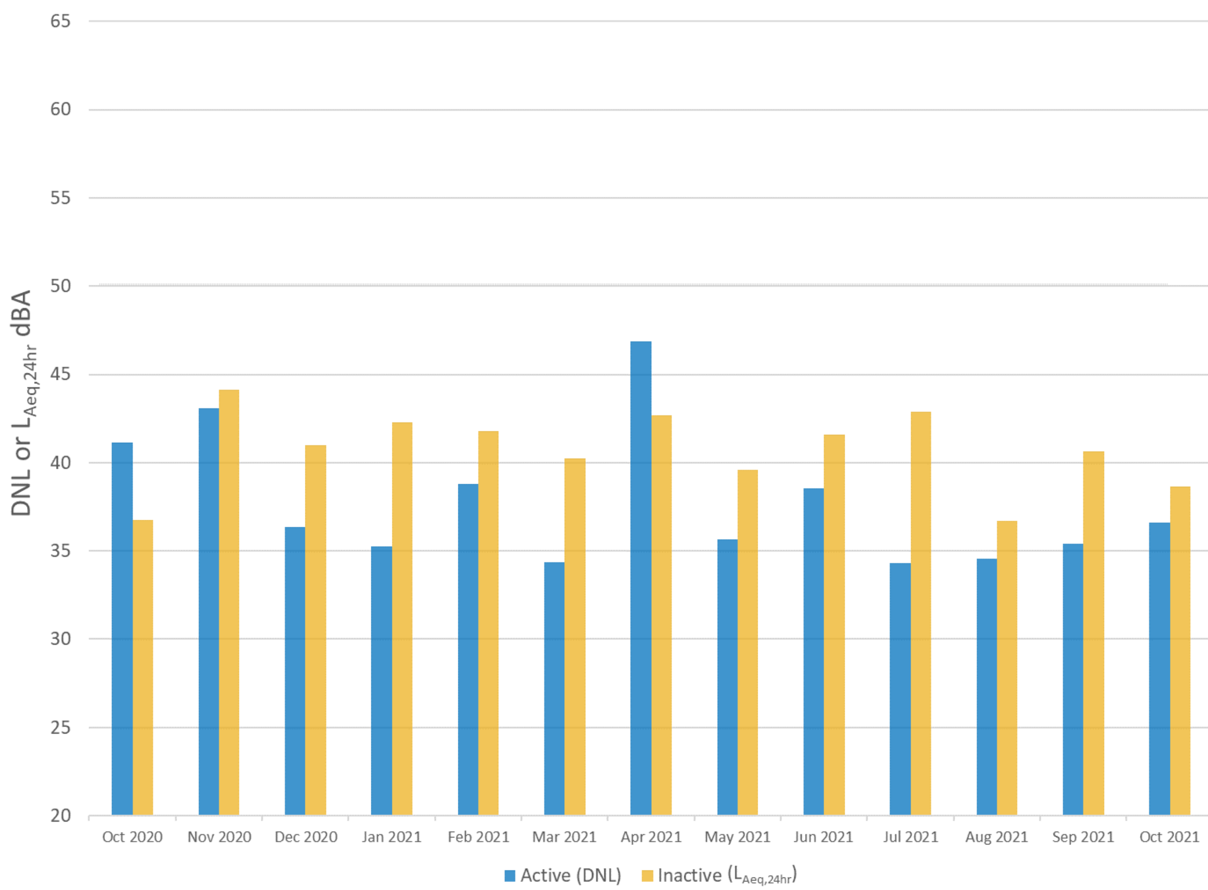


Figure 53. Average Measured Sound Exposure Levels Comparison at Site 99_HOH (*Hoh Rain Forest Visitor Center*) When Olympic MOA is Active and Inactive
Note: Levels for active periods are DNL; levels for inactive periods are $L_{Aeq,24hr}$. Both October values are for partial months.

Table 18 provides the average sound exposure level values associated with Figure 53 along with the difference between the average sound exposure levels for when the MOA was active and inactive. A positive difference indicates that average sound exposure level when the MOA was active was greater than when the MOA was inactive. Natural sounds (e.g., wind blowing through trees and wildlife) contribute to the overall sound level at this location.

Table 18. Comparisons Between Average Sound Exposure Levels at Site 99_HOH (*Hoh Rain Forest Visitor Center*) When Olympic MOA Is Active and Inactive

Month	Active Periods DNL (dBA)	Inactive Periods $L_{Aeq,24hr}$ (dBA)	Difference Between Active DNL and Inactive $L_{Aeq,24hr}$ (dBA)
October 2020[a]	41.2	36.8	4.4
November 2020	43.1	44.1	-1.1
December 2020	36.3	41.0	-4.6
January 2021	35.3	42.3	-7.0
February 2021	38.8	41.8	-3.0
March 2021	34.4	40.2	-5.9
April 2021	46.9	42.7	4.2
May 2021	35.7	39.6	-3.9
June 2021	38.6	41.6	-3.1
July 2021	34.3	42.9	-8.6
August 2021	34.6	36.7	-2.1
September 2021	35.4	40.7	-5.2
October 2021[a]	36.6	38.6	-2.0

Key: DNL = day-night average sound level; $L_{Aeq,24hr}$ = 24-hour equivalent continuous sound level
Note: Shading in the table matches the color scheme in the legend of Figure 53.
[a] Indicates partial month of data. Data were collected from 20 October 2020, through 20 October 2021.

The average difference between active and inactive levels was -2.9 dBA, which indicates that the average sound exposure levels for the active periods were mostly lower. Only two active periods, October 2020 (partial) and April 2021, were higher. Moreover, the month with the highest sortie rate, February 2021, still had average sound exposure levels lower than the inactive periods. This comparison indicates that the military aircraft do not contribute significantly to the overall sound exposure levels at Site 99_HOH (*Hoh Rain Forest Visitor Center*).

This observation may seem counterintuitive; however, it is important to reiterate that the monitoring site only had the potential to receive military aircraft noise when the MOA was active. The sporadic nature of training in the MOA resulted in periods of time when the MOA was active, but the monitoring site only measured other sounds.

The data collected are consistent with the ***previously modeled results*** for the Hoh Rain Forest Visitor Center area, based on the MRNMAP modeled results from the Northwest Training and Testing SEIS/OEIS [4]. The resulting military aircraft are not a significant contributor to the sound levels at the meter location.

5.4 Comparison of SEL Between Real-Time Measured and Real-Time Modeled

In addition to the comparison of DNL and CNEL values, more comparisons between measured and modeled SEL values are provided, since DNL and CNEL are based on the summation of SEL values from individual events (see Appendix A.4.1). These comparisons include SEL values for a specific flight operation type at a given location for both airfields. This section provides descriptions of individual comparisons, and the rest of the comparative plots are provided in Appendix D.

5.4.1 NAS Whidbey Island

In addition to DNL comparisons, the Navy also used SEL values to compare the sound levels of individual events. Figure 54 provides examples of SEL comparisons at Ault Field. The plot on the left in Figure 54 shows the comparison for arrival operations at Site 9B_SG (*NASWI Gate*). The arrivals to Runway 14 are the closest to the site, and the aircraft is still aloft. For the other runways, the aircraft are on the runway at the closest point of approach. In this example, the modeled values tend to be higher than the measured values. The plot on the right in Figure 54 shows the comparison for departures at Site 2B_T (*Seaplane Base*). Departures from Runway 14 overfly this site, whereas the other departures are away from this site. Again, the results are consistent. The agreement is closer between measured and modeled values for Runway 14 departures at Site 2B_T (*Seaplane Base*) since this site is directly overflown by these operations. The outliers shown in both plots demonstrate the large variability observed in individual events due to various environmental and operational factors. The measurement methodology, including multiple monitoring periods covering different environmental and operational conditions, was designed to capture this variability and minimize its effects. All events, including the outliers, are included in the calculation of the real-time measured DNL.

More SEL comparison plots for NAS Whidbey Island are provided in Appendix D.

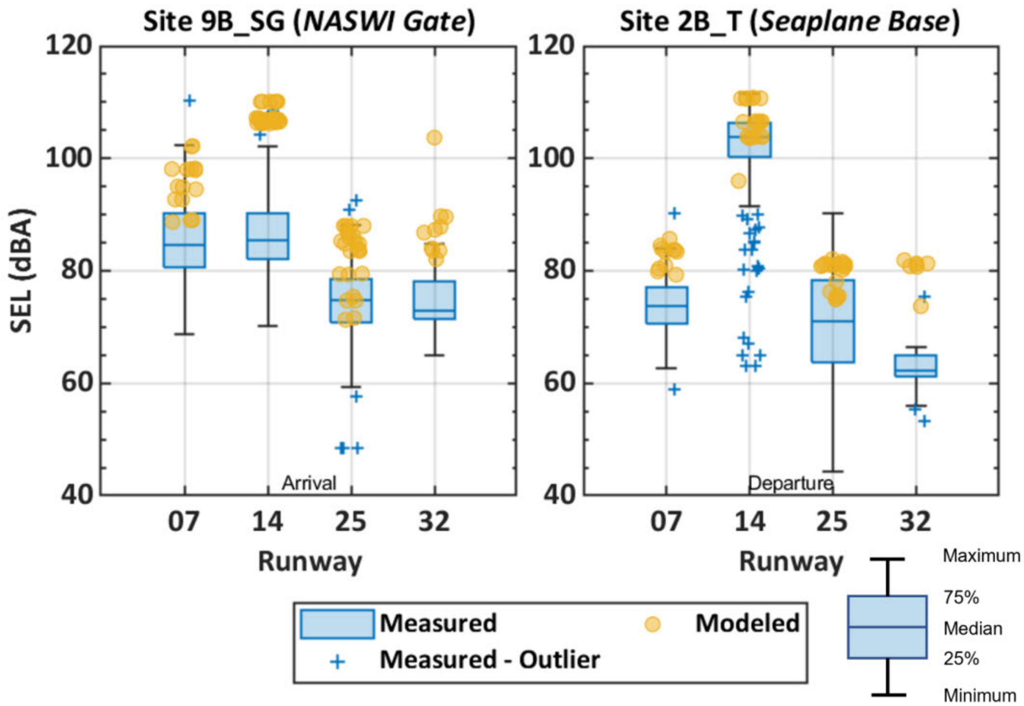


Figure 54. Example Comparisons Between Measured and Modeled SEL Values at Two Monitoring Locations Near Ault Field

5.4.2 NAS Lemoore

With regard to sound levels of individual events, Figure 55 provides examples of SEL comparisons at NAS Lemoore. The plot on the left in Figure 55 shows the comparison for F/A-18E/F overhead break arrival operations at Site 2_T (*NASL Radar*), which indicates that modeled values are higher than measured values. The plot on the right in Figure 55 shows the comparison for F/A-18E/F departures at Site 9_T (*Open Sky Ranch*); in this case the modeled values are higher as well but closer to the measured values because the site is directly overflown by departures from Runways 32L and 32R. The outliers shown in the plot on the right demonstrate the large variability observed in individual events due to various environmental and operational factors. The measurement methodology, including multiple monitoring periods covering different environmental and operational conditions, was designed to capture this variability and minimize its effects. All events, including the outliers, are included in the calculation of the real-time measured CNEL.

More SEL comparison plots for NAS Lemoore are provided in Appendix D.

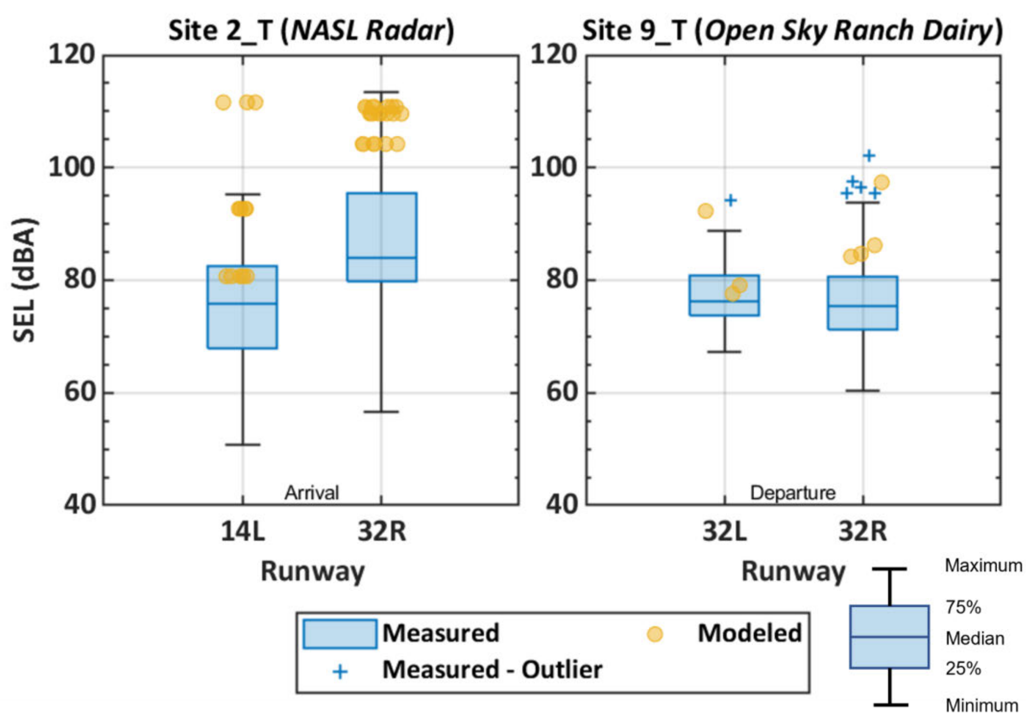


Figure 55. Example Comparisons Between Measured and Modeled SEL Values at Two Monitoring Locations Near NAS Lemoore

6 CONCLUSIONS & SUMMARY

Overall, the Navy determined that the DoD-approved noise models operate as intended and provide an accurate prediction of noise exposure levels from aircraft operations for use in impact assessments and long-term land use planning.

There are two main variables that contribute to accurate noise modeling: a functioning model and accurate input data. The results of this study indicate that the DoD-approved noise models work as intended. Additionally, the noise levels of modeled aircraft (a key input to the model) are accurate as they were obtained by actually measuring sound generated by the aircraft in various parameters under controlled conditions. The largest variable in any aircraft noise-modeling effort is the expected operational flight parameter data. These data include runway and flight track utilization, altitudes at various points in the flight track, and engine power settings among other parameters. Although the results of this study indicate that DoD-approved aircraft noise models work as intended, the Navy will continue to refine operational data collection procedures to enhance model accuracy and reliability.

This report summarizes the methods, data, and results of real-time sound monitoring at NAS Whidbey Island, Washington, and NAS Lemoore, California that supported the Real-Time Aircraft Sound Monitoring report which was submitted to Congress on 01 December 2021 [7]. The following technical data were collected during the real-time monitoring periods and used in the analysis of the sound monitoring study:

- Raw sound level meter data files
- Unified operational data for airfields
- MOA active periods
- Observer logs
- Flight event identification
- NOISEMAP input files
- NOISEMAP output files
- MRNMAP input files
- MRNMAP output files

These data files are available to the public at:

https://www.navfac.navy.mil/products_and_services/am/products_and_services/Sound_Monitoring.html

REFERENCES

[1] *Quantities and Procedures for Description and Measurement of Environmental Sound. Part 2: Measurement of long-term, wide-area sound.*, ANSI, New York, 1992.

[2] U. S. Navy, "Environmental Impact Statement for EA-18G "Growler" Airfield Operations at Naval Air Station Whidbey Island Complex," United States Department of the Navy, 2018, vol. 2. [Online]. Available: https://www.nepa.navy.mil/growler/EIS-Docs/

[3] U. S. Navy, "Environmental Impact Statement US Navy F-35C West Cost Homebasing," United States Department of the Navy, 2014, vol. 2. [Online]. Available: https://www.cnic.navy.mil/regions/cnrsw/installations/nas_lemoore/om/environmental_support.html

[4] U. S. Navy, "Northwest Training and Testing Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement," United States Department of the Navy, 2020, vol. 4. [Online]. Available: https://nwtteis.com/Documents/2020-Northwest-Training-and-Testing-Final-Supplemental-EIS-OEIS/Final-Supplemental-EIS-OEIS

[5] U. S. DoD, "DoD Instruction 4715.13 DoD Operational Noise Program," United States Department of Defense, 2020.

[6] J. N. Cole, "USAF Bioenvironmental Noise Data Handbook: Volume 1. Organization, Content, and Application," Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, AMRL-TR-75-50, 1975, vol. 1.

[7] U. S. Navy, "Report to Congress Real-Time Aircraft Sound Monitoring Final Report," United States Department of the Navy, November 30, 2021 2021.

[8] *Acoustics - Unattended monitoring of aircraft sound in the vicinity of airports*, 20906, ISO, 2009.

[9] *Monitoring Aircraft Noise and Operations in the Vicinity of Airports: System Description, Acquisition, and Operation*, ARP4721 Part 1, SAE, 2012.

[10] *Quantities and Procedures for Description and Measurement of Environmental Sound. Part 4: Noise Assessment and Prediction of Long-term Community Response.*, ANSI, New York, 2005.

[11] R. Hendriks, B. Rymer, D. Buehler, and J. Andrews, "Technical Noise Supplement to the Traffic Noise Analysis Protocol," California Department of Transportation, CT-HWANP-RT-13-069.25.2, September 2013.

[12] H. F. Boersma, "Characterization of the natural ambient sound environment: Measurements in open agricultural grassland," *The Journal of the Acoustical Society of America,* vol. 101, no. 4, pp. 2104-2110, 1997.

[13] F. I. C. o. N. (FICON), "Federal Agency Review of Selected Airport Noise Analysis Issues," 1992.

[14] E. Stusnick, D. Bradley, M. Bossi, and D. Rickert, "The Effect of Onset Rate on Aircraft Noise Annoyance, Vol 3: Hybrid Own-Home Experiment," Wyle Laboratories, WR 93-22, December 1993 1993.

[15] F. I. C. o. U. N. (FICUN), "Guidelines for Considering Noise in Land-Use Panning and Control," June 1980.

[16] U. S. EPA, "Guidelines for Noise Impact Analysis," United States Environmental Protection Agency, 550/9-82-105, April 1982.

[17] *Quantities and Procedures for Description and Measurement of Environmental Sound - Part 5: Sound Level Descriptors for Determination of Compatible Land Use*, ANSI, New York, 2007.

[18] T. J. Schultz, "Synthesis of social surveys on noise annoyance," *J Acoust Soc Am,* vol. 64, no. 2, pp. 377-405, Aug 1978, doi: 10.1121/1.382013.

[19] S. Fidell, D. S. Barger, and T. J. Schultz, "Updating a Dosage-Effect Relationship for the Prevalence of Annoyance Due to General Transportation Noise," *J. Acoust. Soc. Am.*, vol. 89, pp. 221-233, January 1991, doi: 10.1121/1.400504.

[20] L. S. Finegold, C. S. Harris, and H. E. von Gierke, "Community Annoyance and Sleep Disturbance: Updated Criteria for Assessing the Impacts of General Transportation Noise on People," *Noise Control Engineering Journal,* vol. 42, 1, 1993.

[21] W. A. Rosenblith and K. N. Stevens, "Handbook of Acoustic Noise Control Volume II. Noise and Man," Wright Air Development Center, WADC Technical Report 52-204, June 1953.

[22] K. Stevens, W. Rosenblith, and R. Bolt, "Neighborhood Reaction to Noise: A Survey and Correlation of Case Histories," *The Journal of the Acoustical Society of America,* vol. 25, no. 4, pp. 833-833, 1953.

[23] *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, EPA, Washington, D.C., 1974.

[24] F. I. C. o. A. N. (FICAN), "Effects of Aviation Noise on Awakenings from Sleep," June 1997.

[25] S. Fidell and L. Silvati, "Parsimonious alternatives to regression analysis for characterizing prevalence rates of aircraft noise annoyance," *Noise Control Engineering Journal,* vol. 52, no. 2, pp. 56-68, 2004.

[26] B. A. Corporation, "New parallel runway draft environmental impact statement/major-development plan," 2007, vol. D - Airspace, Chapter 7: Human Impact Assessment. Accessed: May 7, 2018. [Online]. Available: https://www.bne.com.au/sites/default/files/docs/BNR_EIS_MDP_D7_Health_Impact_Assess.pdf

[27] J. S. Newman and K. R. Beattie, "Aviation Noise Effects," Federal Aviation Adminstration, March 1985.

[28] D. Schreckenberg and R. Schuemer, "The impact of acoustical, operational and non-auditory factors on short-term annoyance due to aircraft noise," in *Proceedings of the 39th international congress and exposition on noise control engineering (Internoise 2010), Lisbon, Portugal*, 2010, pp. 13-16.

[29] H. Laszlo, E. McRobie, S. Stansfeld, and A. Hansell, "Annoyance and other reaction measures to changes in noise exposure—A review," *Science of the total environment,* vol. 435, pp. 551-562, 2012.

[30] F. Marki, "Outcomes of EU COSMA (Community Oriented Solutions to Minimise Aircraft Noise Annoyance) Project," in *Budapest University of Technology and Economics*, London, May 2013 2013.

[31] H. M. Miedema and H. Vos, "Exposure-response relationships for transportation noise," *The Journal of the Acoustical Society of America,* vol. 104, no. 6, pp. 3432-3445, 1998.

[32] H. M. Miedema and H. Vos, "Noise sensitivity and reactions to noise and other environmental conditions," *The Journal of the Acoustical Society of America,* vol. 113, no. 3, pp. 1492-1504, 2003.

[33] K. J. Plotkin, B. Sharp, T. Connor, R. Bassarab, J. Rachami, I. Flindell, and D. Schreckenberg, "Updating and Supplementing the Day-Night Average Sound Level (DNL)," Wyle Laboratories, WR 11-04, DOT/FAA/AEE/2011-03, June 11 2011.

[34] D. o. D. N. W. G. (DNWG), "Technical Bulletin - Using Supplemental Noise Metrics and Analysis Tools," December 2009.

[35] H. Miedema and C. Oudshoorn, "Annoyance from transportation noise: relationships with exposure metrics DNL and DENL and their confidence intervals," *Environmental health perspectives,* vol. 109, no. 4, pp. 409-416, 2001.

[36] B. Berglund, T. Lindvall, and D. H. Schwela, "Guidelines for Community Noise," World Health Organization, 1999.

[37] *International standard, acoustics, description, measurement, and assessment of environmental noise – Part 1: Basic quantities and assessment procedures*, 1996-1:2016, ISO, March 1, 2016 1996.

[38] W. Babisch, D. Houthuijs, G. Pershagen, E. Cadum, K. Katsouyanni, M. Velonakis, M.-L. Dudley, H.-D. Marohn, W. Swart, and O. Breugelmans, "Annoyance due to aircraft noise has increased over the years—Results of the HYENA study," *Environment international,* vol. 35, no. 8, pp. 1169-1176, 2009.

[39] N. P. Miller, J. J. Czech, K. M. Hellauer, B. L. Nicholas, S. Lohr, E. Jodts, P. Broene, D. Morganstein, J. Kali, X. Zhu, D. Cantor, J. Hudnall, and K. Melia, "Analysis of the Neighborhood Environmental Survey," Federal Aviation Administration, DOT/FAA/TC-21/4, February 2021.

[40] A. Brown and I. van Kamp, "Towards a design for studies of response to change in noise exposure," in *INTER-NOISE and NOISE-CON Congress and Conference Proceedings*, 2005, vol. 2005, no. 5: Institute of Noise Control Engineering, pp. 2958-2967.

[41] R. Guski, "How to forecast community annoyance in planning noisy facilities," *Noise and Health,* vol. 6, no. 22, p. 59, 2004.

[42] F. Wasmer and F. Maunsell, "BaseOps 7.3 User's Guide," Wasmer Consulting, 2006. [Online]. Available: https://wasmerconsulting.com/baseops.htm

[43] H. T. Mohlmann, "Computer Programs for Producing Single-Event Aircraft Noise Data for Specific Engine Power and Meteorological Conditions for Use with USAF Community Noise Model (NOISEMAP)," Air Force Aerospace Medical Research Laboratory, AFAMRL-TR-83-020, April 1983.

[44] J. M. Downing, "Validation of Updates to NoiseFile Database and NoiseMap Modeling Software," Blue Ridge Research and Consulting, LLC, 16-16, 2016.

[45] F. Wasmer and F. Maunsell, "NMPlot 4.9 User's Guide," Wasmer Consulting, 2006. [Online]. Available: https://wasmerconsulting.com/nmplot.htm

[46] C. L. Moulton, "Air Force Procedure for Predicting Noise Around Airbases: Noise Exposure Model (NOISEMAP) Technical Report," Armstrong Laboratory, Wright-Patterson Air Force Base, AL-TR-1992-0059, May 1992.

[47] K. A. Bradley, "Routemap Version 2.0: Military Training Route Noise Model User's Manual," Armstrong Research Laboratory, Wright-Patterson Air Force Base, OH, AL/OE-MN-1996-0002, 1996.

APPENDIX A SOUND: BASICS, METRICS, AND THE EFFECT OF ENVIRONMENT

Sound is all around us; sound becomes noise when it is judged to be unwanted. An assessment of aircraft noise requires a general understanding of how sound affects people and the natural environment, as well as how it is measured.

A.1 Sound

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium such as air, and they are sensed by the human ear. The sounds waves move outward as a series of crests, in which the air is compressed, and troughs, in which the air is expanded. The height of the crests and the depth of the troughs determines the amplitude of the sound wave. The sound pressure determines the sound wave's energy, or intensity. The number of crests or troughs that pass a given point each second is called the frequency of the sound wave.

The measurement and human perception of sound involves three basic physical characteristics: intensity, frequency, and duration.

- *Intensity* is a measure of the acoustic energy of a sound and is related to sound pressure. The greater the sound pressure, the more energy is carried by the sound and the louder the perception of that sound will be.
- *Frequency* determines how the pitch of a sound is perceived. Low-frequency sounds are characterized as rumbles or roars, while high-frequency sounds are often described as sounding like sirens or screeches.
- *Duration* is the length of time a sound can be detected.

The loudest sounds that can be comfortably heard by the human ear have intensities a trillion times higher than those of sounds barely heard. Because of this vast range, it is unwieldy to use a linear scale to represent the intensity of sound. As a result, a logarithmic unit known as the decibel (dB) is used to represent the intensity of a sound. Such a representation is called a sound level and is abbreviated as L. A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels above 120 dB would be uncomfortable for the average person, and levels of 130 to 140 dB would start to be felt as pain. It is important to realize some people will be more sensitive to sound and some less sensitive; therefore, the level at which sound becomes uncomfortable or painful will vary across the population.

Sound spreads out uniformly as it travels away from its source. This spreading causes the sound's intensity to decrease with distance from the source. For a point source of a sound, such as an air conditioning unit, the sound level will decrease by about 6 dB for every doubling of its distance from a receiver. For a busy highway, which creates a linear distribution of noise sources, the sound level will decrease by 3 to 4.5 dB for every doubling of distance.

As sound travels from its source, it is also absorbed by the air. The amount of absorption depends on the frequency composition of the sound and the temperature and humidity of the air. Sound with high-frequency content, such as a human voice, gets absorbed by the air more readily than sound with low-frequency content, such as a military jet. More sound is absorbed in colder and drier air than in hot and wet air. Sound is also affected by wind and temperature gradients, terrain (elevation and ground cover), and structures.

Because of the logarithmic nature of the dB unit, sound levels cannot simply be added or subtracted and are somewhat cumbersome to handle mathematically. However, some simple rules are useful in understanding sound levels.

First, if a sound's intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. For example:

60 dB + 60 dB = 63 dB, and

80 dB + 80 dB = 83 dB.

Second, the total sound level produced by two sounds of different levels is usually only slightly greater than the higher of the two. For example:

60.0 dB + 70.0 dB = 70.4 dB.

Because the addition of sounds of differing levels is different than that of simply adding numbers, this process is often referred to as "decibel addition".

The minimum change in the sound level of individual events that an average human can detect is about 3 dB. On average, a person perceives a change in sound level of about 10 dB as a doubling (or halving) of that sound's loudness. This relation holds true for both loud and quiet sounds. A decrease in sound level of 10 dB actually represents a 90 percent decrease in sound intensity but only a 50 percent decrease in perceived loudness because the human ear does not respond to sound linearly. Intensity of a sound is the physical measure of the stimulus, and loudness of a sound is the perceptual measure of a listener's response to it.

A.2 Frequency Weighting

Most sounds contain a mixture of many frequencies simultaneously. The human ear varies in its sensitivity to sounds of different frequencies. Experts have developed weighting curves to correspond to the sensitivity and loudness perception of different frequencies of sound. A-weighting is the most common adjustment for human perception to environmental sounds, as it emulates the frequency sensitivities of the human ear. Figure A-1 shows the A-weighted response curve as a function of frequency. The weightings are positive between 1,000 Hz to 5,000 Hz, which corresponds to the primary range of human speech.

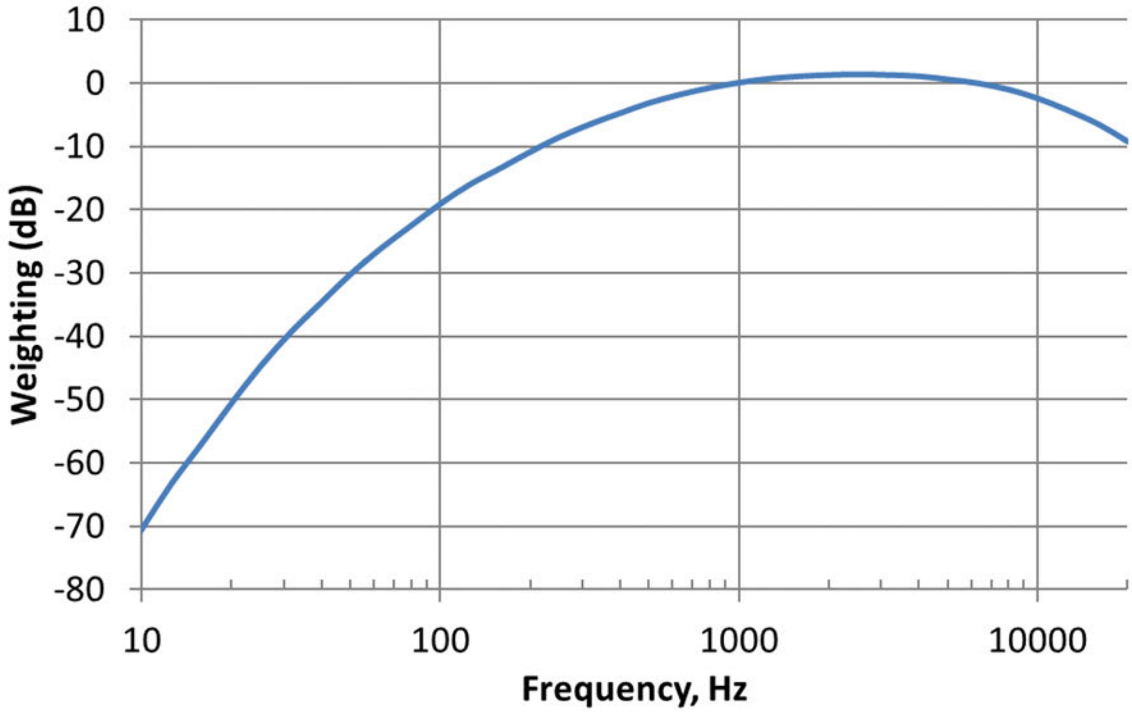


Figure A-1. A-weighted Frequency Response Curve

In accordance with DoD policy and with federal standards adopted by DoD, the Federal Aviation Administration, and other federal agencies, the Navy's aircraft noise analysis uses A-weighted noise metrics [13].

A.3 The Effect of Weather Conditions on Sound Propagation

Several atmospheric effects influence the propagation of sound, and they can interact with each other. Specific combinations of conditions influence propagation and, it is helpful to understand these varied effects. Atmospheric conditions that influence the propagation of sound include temperature, wind, turbulence, humidity, and precipitation. The effect of wind and turbulence is generally more important than the effects of other factors. Under calm wind conditions, the importance of temperature increases. Humidity generally has little significance relative to the other effects.

A.3.1 Influence of Temperature

Air temperature affects the velocity of sound in the atmosphere. As a result, if the temperature varies at different heights above the ground, sound will travel in curved paths rather than straight lines (Figure A-2). This bending of the sound path is called "refraction." During the day, temperature normally decreases with increasing height. Under such "temperature lapse" conditions, when the air temperature decreases with height, the atmosphere refracts ("bends") sound waves upward, and an acoustical shadow zone may exist at some distance from the noise source.

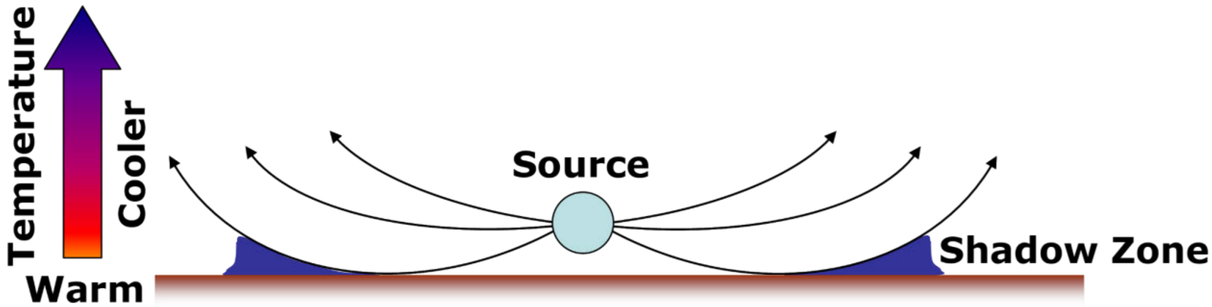


Figure A-2. Influence of Temperature on Sound Propagation During Temperature Lapse

Under some weather conditions, an upper level of warmer air may trap a lower layer of cool air. Such temperature inversions are most common in the evening, at night, and early in the morning, when heat absorbed by the ground during the day radiates into the atmosphere. The effect of an inversion is just the opposite of lapse conditions: it causes sound propagating through the atmosphere to refract downward (Figure A-3).

The downward refraction caused by temperature inversions often allows sound rays with originally upward-sloping paths to bypass obstructions and ground effects, increasing noise levels at greater distances.

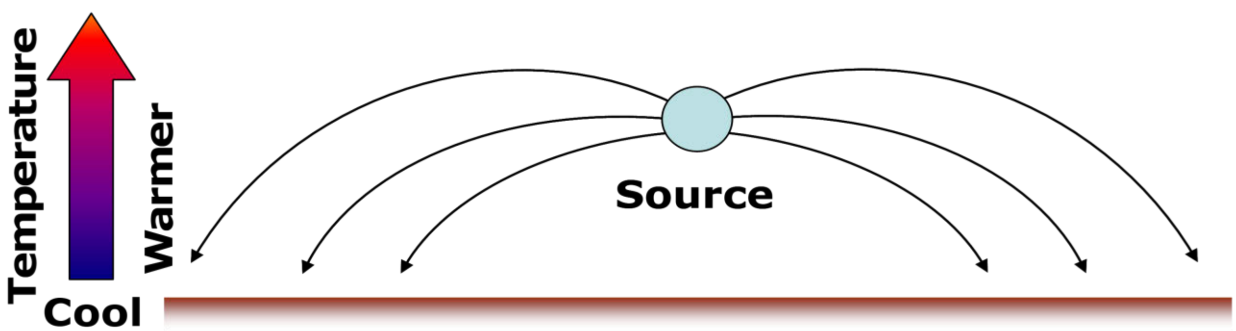


Figure A-3. Influence of Temperature on Sound Propagation during Temperature Inversion

A.3.2 Influence of Wind

Sound traveling in the direction of the wind (downwind) has a higher effective speed of sound than sound traveling through calm air. Likewise, sound traveling against the direction of the wind (upwind) has a lower effective speed of sound than sound traveling through calm air. Wind speed typically increases with the height above the ground. This gradient in wind speeds, and sound speeds, causes the sound to refract. Sound refracts downward in the downwind direction and upward in the upwind direction (Figure A-4).

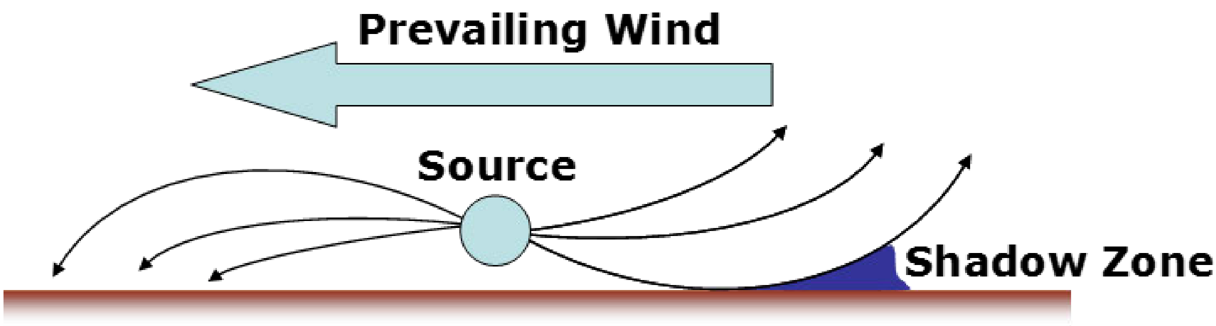


Figure A-4. Influence of Wind on Sound Propagation

In general, receivers that are downwind of a noise source will experience higher sound levels, and those that are upwind will experience lower sound levels. As with a temperature inversion, the downward curving paths reduce or eliminate the insertion loss of barriers in the downwind direction. Wind that is perpendicular to the sound path has no significant effect.

In addition, gustiness can cause considerable attenuation of sound due to the effects of eddies traveling with the wind. Attenuation due to eddies is essentially the same in all directions, with, or against, the flow of the wind, and can mask the refractive effects discussed above.

A.3.3 Influence of Turbulence

Atmospheric turbulence also affects sound propagation, and it is generally classified as either mechanical (wind turbulence) or thermal (calm hot "boiling" of heated ground). Turbulence causes sound levels heard at remote receiver locations to fluctuate. As the strength of turbulence increases, the larger the fluctuation of the received sound level. The average received level is generally not affected by turbulence. However, the most important effect of turbulence is that it allows sound to penetrate the shadow zones noted in Figure A-1 and Figure A-3. In the physical propagation of sound, turbulence causes scattering of the propagating sound energy. This scattering results in some of the sound energy crossing over into the shadow zone.

A.3.4 Influence of Humidity and Precipitation

Humidity and precipitation rarely affect sound propagation in a significant manner. Humidity can reduce propagation of high-frequency noise under calm wind conditions. In very cold conditions, listeners often observe that noise sources such as aircraft sound "tinny," because the dry air increases the propagation of high-frequency sound. Rain, snow, and fog also have little, if any, noticeable effect on sound propagation. A substantial body of empirical data supports these conclusions.

A.4 Sound Metrics Used for Aircraft Noise

Sound metrics quantify sounds so they can be compared with each other, and with their effects, in a standard way. A number of metrics can be used to describe a range of situations – from the effect of a particular noise event to the cumulative effects of all noise events over a long time.

The metrics discussed in this report are defined below and cover both cumulative and single aircraft events. The Navy used the Day-Night Average Sound Level (DNL) and Community Noise Equivalent Level (CNEL) metrics to compare monitoring data with NOISEMAP results.

DNL and CNEL are used as the primary comparative metrics in this study because they provide a complete picture of the overall noise environment; they are the primary metrics calculated by NOISEMAP; and they are the federal standard [13] used to produce aircraft noise exposure contours in impact assessments and other land use planning documents. These metrics are normally presented as noise contours, which show the exposure levels and their range over the surrounding areas near an airfield. For this study, the comparisons are for specific points corresponding to the monitoring locations. The Navy also used the Sound Exposure Level (SEL) to compare the sound levels of individual events.

A.4.1 Cumulative Metrics

For airports and military airfields, DNL and CNEL represent the average sound level for an average annual day. These metrics are cumulative because they consider both: (1) the noise levels of all individual noise events that occur during a 24-hour period, and (2) the number of times those events occur. These cumulative metrics do not reflect the actual sound level experienced at any point in time. These metrics help assess the effect of aircraft noise on nearby communities.

Day-Night Average Sound Level (DNL)

DNL is a cumulative metric that accounts for all noise events, such as aircraft operations, in a representative 24-hour period (Figure A-5). It also contains a nighttime noise adjustment to account for humans' increased sensitivity to noise at night; DNL applies a 10 A-weighted decibels (dBA) adjustment (penalty) to noise events that occur during the nighttime period, defined as 22:00 to 07:00.

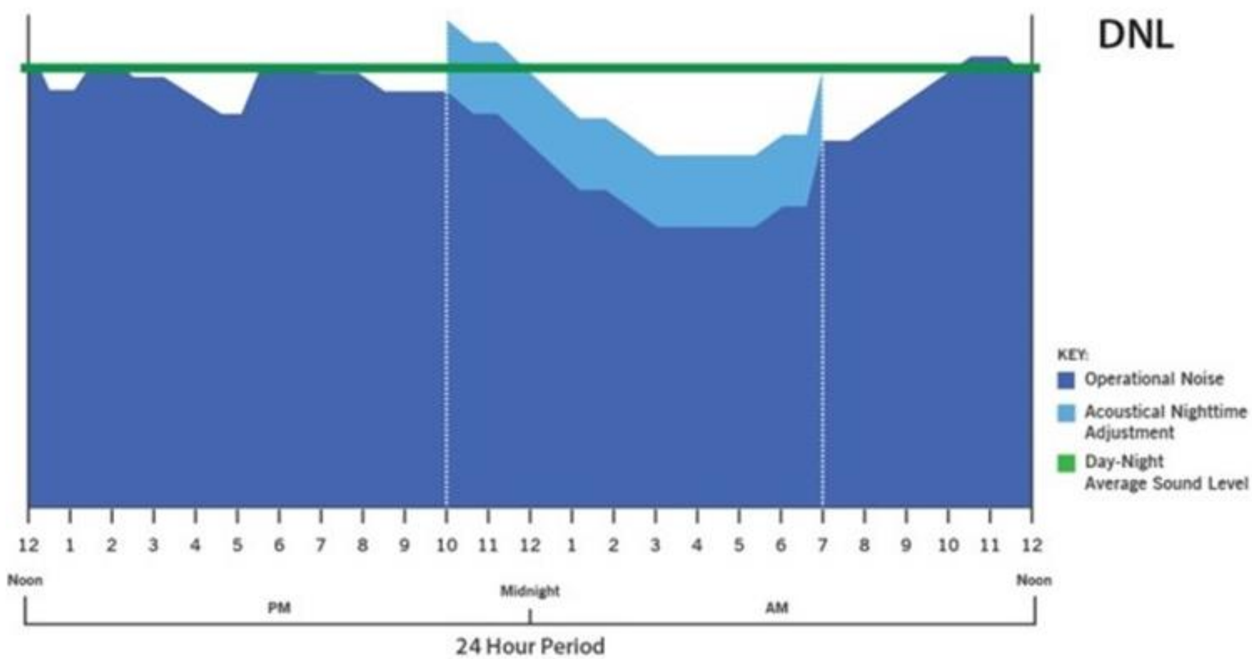


Figure A-5. Representation of Day-Night Average Sound Level

The calculation of modeled DNL values involves the summation of SELs from all modeled operations (see Appendix A.4.2 below) over a two-period day. First, the DNL value for an individual operation is calculated by eq. (A.1). Second, the individual DNL values are summed on an energy basis to determine the overall DNL value (eq. (A.2)).

$$DNL_i = SEL_i + 10\log_{10}\left[N_{day,i} + 10N_{night,i}\right] - 49.4\text{dB} \quad \text{(A.1)}$$

where

- *DNL_i* is the DNL of the i^th operation
- *SEL_i* is the SEL of the i^th operation
- *$N_{day,i}$* is the number of acoustic day events of i^th operation
- *$N_{night,i}$* is the number of acoustic night events of the i^th operation

$$DNL = 10\log_{10}\left[\sum_{i=1}^{n} 10^{\frac{DNL_i}{10}}\right] \quad \text{(A.2)}$$

where

- *DNL* is the overall DNL for all of the operations
- *n* is the total number of operations

Community Noise Equivalent Level (CNEL)

CNEL is a variation of DNL. CNEL is only used in California, so it only applies to NAS Lemoore in this study. In addition to the 10 dBA adjustment for DNL, it also includes a 4.77 dBA adjustment for events occurring during the evening period of 19:00 to 22:00.

The calculation of modeled CNEL values involves the summation of SELs from all modeled operations (see Appendix A.4.2 below) over a three-period day. First, the CNEL value for an individual operation is calculated by eq. (A.3). Second, the individual CNEL values are summed on an energy basis to determine the overall CNEL value (eq. (A.4)).

$$CNEL_i = SEL_i + 10\log_{10}\left[N_{day,i} + 3N_{evening,i} + 10N_{night,i}\right] - 49.4\text{dB} \quad \text{(A.3)}$$

where

- *$CNEL_i$* is the CNEL of the i^th operation
- *SEL_i* is the SEL of the i^th operation
- *$N_{day,i}$* is the number of acoustic day events of i^th operation
- *$N_{evening,i}$* is the number of acoustic evening events of the i^th operation
- *$N_{night,i}$* is the number of acoustic night events of the i^th operation

$$CNEL = 10\log_{10}\left[\sum_{i=1}^{n} 10^{\frac{CNEL_i}{10}}\right] \quad \text{(A.4)}$$

where

- *CNEL* is the overall CNEL for all of the operations
- *n* is the total number of operations

Onset-Rate Adjusted Monthly Day-Night Average Sound Level (L_{dnmr})

The L_{dnmr} metric is used to assess noise under or near special use airspace (SUA) and other areas where military aircraft conduct much of their training (e.g., low-level training routes, MOAs, and restricted airspace). The land areas underneath and near these training airspaces only receive aircraft on a sporadic nature because the training flights are highly variable in terms of both time and space. Additionally, if a person is near a low-altitude, high-speed flight, then they be surprised by the sudden onset if the aircraft noise. Thus, the United States Air Force developed a modified version of DNL for assessing noise in flight routes, which makes adjustments for the sudden increase in (or onset of) noise and the sporadic nature of the sounds [14]. The "m" in L_{dnmr} defines the intermittent nature of the aircraft noise from SUA and is averaged over the busiest month. The "r" accounts for the added annoyance from the "surprise factor" of the rapid-onset rates. This metric is a model-based metric since it is not measured directly by sound level meters. Additionally, the rapid-onset adjustment is minimal for flight altitudes above 2,000 feet, lateral offset greater than 2,000 feet, or airspeeds below 450 knots.

A.4.2 Single Aircraft Event Metrics

Maximum Sound Level (L_{Amax})

Aircraft sounds are generally transient with a defined duration. Aircraft sounds increase in level as the aircraft approaches, reach a maximum level when the aircraft flies overhead, and then decrease as the aircraft departs. L_{Amax} represents the maximum sound level that a person would hear on the ground as an aircraft flies over.

Sound Exposure Level (SEL)

SEL includes all the noise levels produced as part of the aircraft overflight, together with how long it lasts. Figure A-6 demonstrates how SEL does not directly represent the sound level heard at any given time during a flyover event but rather is a measure of noise representing the entire flyover event. As a result, SEL provides a more accurate measure of aircraft flyover noise exposure than L_{Amax} alone. Additionally, SEL is the basic metric used to calculate DNL. For a typical aircraft flyover event, the SEL will be greater than the L_{Amax}, since SEL is compressed into 1 second.

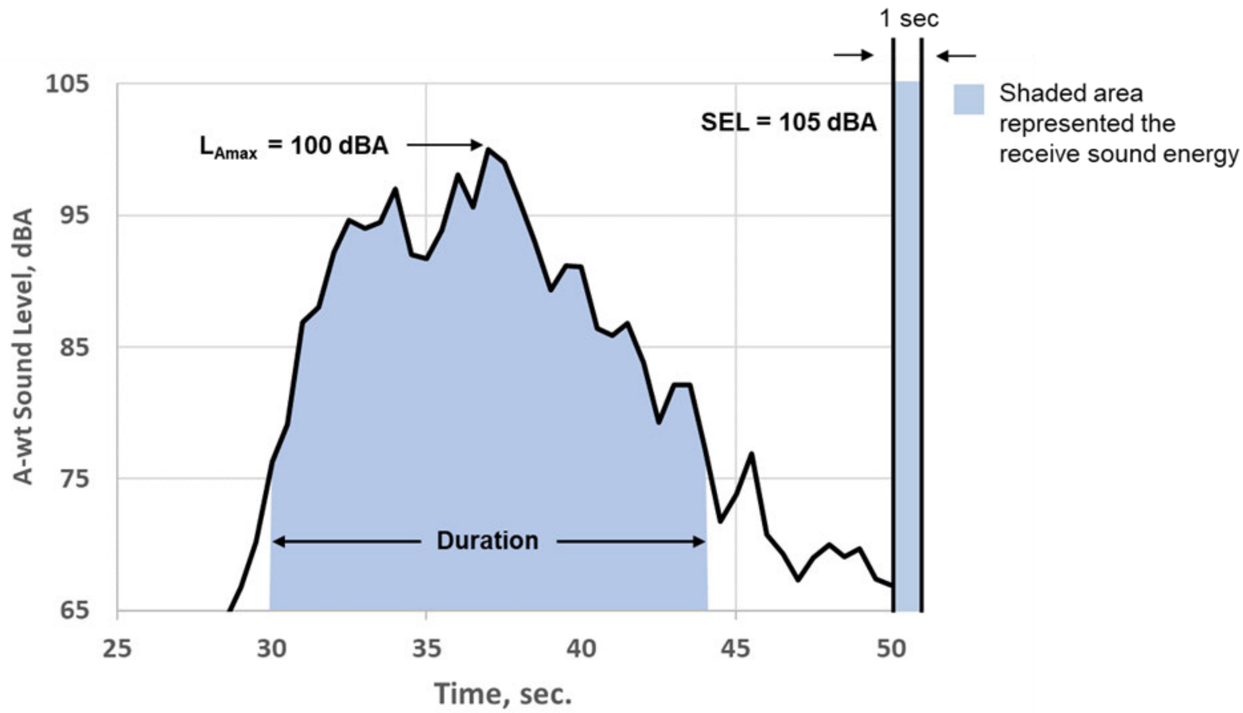


Figure A-6. Representative Sample of Single Aircraft Event Metrics

Equivalent Continuous Sound Level (L_{Aeq})

The L_{Aeq} averages the acoustic energy over a specific period of time and represents the continuous sound level over that period that generates the same acoustic energy exposure. The period can be any length of time, but it usually is a meaningful block of time, such as a 24-hour period ($L_{Aeq,24hr}$), an 8-hour period ($L_{Aeq,8hr}$) for the office, or a 1-hour period ($L_{Aeq,1hr}$) for a lecture.

A.4.3 The Use of DNL and CNEL as the Primary Metric for Long-term Noise Exposure

The DoD established the Operational Noise Program in *DoD Instruction 4715.3* [5]. The instruction defines the elements of the noise program at a high level and provides guidance on conducting noise studies. The instruction states, "DoD noise models and scientifically validated noise descriptors (i.e., metrics) will be used as the primary means of analyzing military noise, noise impacts, and compatible land use" [5]. The primary metric for aircraft noise studies, as required by the DoD, is the Day-Night Average Sound Level (DNL), except in California, where the Community Noise Equivalent Level (CNEL) is used.

DNL and CNEL are well-established sound metrics for aircraft noise. The Federal Interagency Committee on Urban Noise (FICUN), formed in 1979, published *Guidelines for Considering Noise in Land-Use Planning and Control* [15]. These guidelines complement federal agency criteria by providing for the consideration of noise in all land-use planning and interagency/intergovernmental processes. The FICUN-established DNL is the most appropriate descriptor for all noise sources. In 1982, the Environmental Protection Agency (EPA) published *Guidelines for Noise Impact Analysis* to provide all types of decision-makers with analytic procedures to uniformly express and quantify noise impacts.[16] The American National Standards Institute (ANSI) endorsed DNL in 1990 as the "acoustical measure to be used in assessing compatibility between various land uses and outdoor noise environment" [17]. In 1992, the Federal Interagency Committee on Noise reaffirmed the use of DNL as the principal aircraft noise descriptor in the document entitled *Federal Agency Review of Selected Airport Noise Analysis Issues* [13]. In general, scientific studies and social surveys have found a high correlation between the percentages of groups of people highly annoyed and the level of average noise exposure measured in DNL [18-20].

Although DNL provides a single measure of the overall noise impact, it does not provide specific information on the number of noise events or the individual sound levels that occur during the 24-hour period. For example, a daily average sound level of 65 dB could result from only a few loud events or many relatively quiet events.

A.4.4 Annoyance (from Section A1.3.1 of Growler EIS)

With the introduction of jet aircraft in the 1950s, it became clear that aircraft noise annoyed people and was a significant problem around airports. Early studies, such as those of Rosenblith et al. [21] and Stevens et al. [22], showed that effects depended on the quality of the sound, its level, and the number of flights. Over the next 20 years, considerable research was performed refining this understanding and setting guidelines for noise exposure. In the early 1970s, the USEPA published its "Levels Document" [23], which reviewed the noise factors that affected communities. DNL (or L_{dn}) was identified as an appropriate noise metric, and threshold criteria were recommended.

Threshold criteria for annoyance were identified from social surveys, in which people exposed to noise were asked how noise affected them. Surveys provide direct real-world data on how noise affects actual residents.

Surveys in the early years had a range of designs and formats, and they needed some interpretation to find common ground. In 1978, Schultz showed that the common ground was the number of people "highly annoyed," defined as the upper 28 percent range of whatever response scale a survey used [18]. With that definition, Schultz was able to show a remarkable consistency among the majority of the surveys for which data were available. Figure A-7 shows the result of his study relating DNL to individual annoyance as measured by percent highly annoyed.

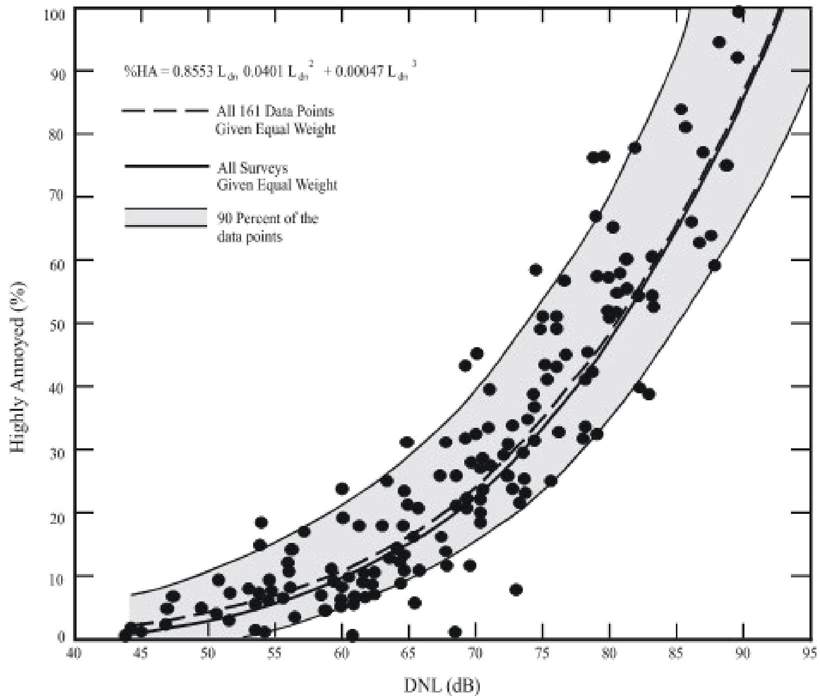


Figure A-7. Schultz Curve Relating Noise Annoyance to DNL

Schultz's original synthesis included 161 data points. Figure A-8 compares revised fits of the Schultz dataset with an expanded set of 400 data points collected through 1989 The new form of the curve is the preferred form in the U.S., endorsed by FICAN [24]. Other forms have been proposed, such as that of Fidell and Silvati [25], but these have not gained widespread acceptance.

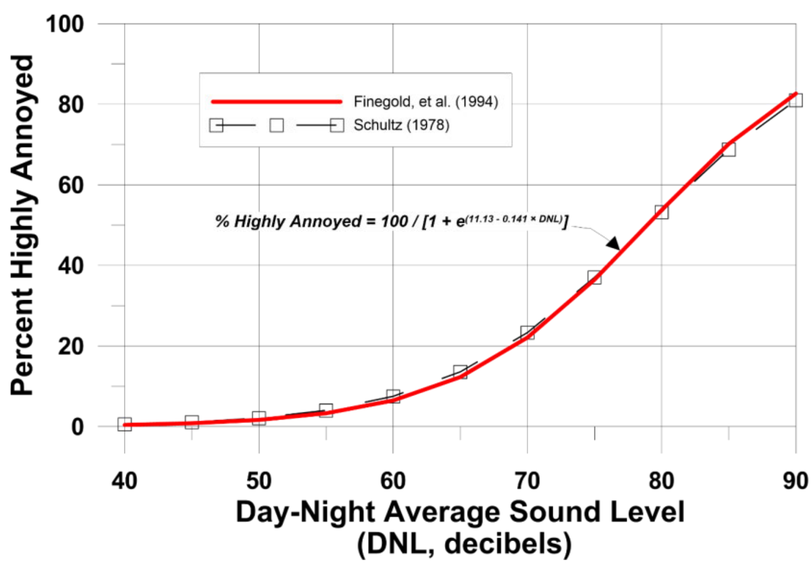


Figure A-8. Response of Communities to Noise: A Comparison of Original Schultz (1978) Curve [18] to Finegold et al. (1993) Curve [20]

When the goodness of fit of the Schultz curve is examined, the correlation between groups of people is high, in the range of 85 to 90 percent. However, the correlation between individuals is much lower, at 50 percent or less. This finding is not surprising, given the personal differences between individuals, with some people more sensitive to noise than others. The surveys underlying the Schultz curve include results that show that annoyance from noise is also affected by non-acoustical factors. The influence of non-acoustical factors is a complex interaction influencing an individual's annoyance response to noise [26]. Newman and Beattie [27] divided the non-acoustic factors into the emotional and physical variables shown in Table A-1.

Table A-1. Non-acoustic Variables Influencing Aircraft Noise Annoyance

Emotional Variables	Physical Variables
Feeling about the necessity or preventability of the noise	Type of neighborhood
Judgement of the importance and value of the activity that is producing the noise	Time of day
Activity at the time an individual hears the noise	Season
Attitude about the environment	Predictability of the noise
General sensitivity to noise	Control over the noise source
Belief about the effect of noise on one's health	Length of time an individual is exposed to a noise
Feeling of fear associated with the noise	

Schreckenberg and Schuemer [28] and Laszlo et al. [29] examined the importance of some of these factors on short-term annoyance. Attitudinal factors were identified as having an effect on annoyance. In formal regression analysis, however, L_{eq} was found to be more important than attitude. Similarly, a series of studies conducted by Marki [30] at three European airports showed that less than 20 percent of the variance in annoyance can be explained by noise alone. Miedema and Voss [31] found that fear and noise sensitivity have a significant influence on an individual annoyance response. Moreover, in another study, they demonstrated that noise sensitivity is not a function of noise exposure and that noise-sensitive individuals have a steeper annoyance response to increasing noise levels compared to people who are not noise sensitive [32].

A study by Plotkin et al. [33] examined updating DNL to account for these non-acoustic variables. Plotkin et al. [33] concluded that the data requirements for a general analysis were much greater than are available from most existing studies. It was noted that the most significant issue with DNL is that the metric is not readily understood by the public and that supplemental metrics such as TA and NA were valuable in addressing attitude when communicating noise analysis to communities [34].

A factor that is partially non-acoustical is the source of the noise. Miedema and Vos [31] presented synthesis curves for the relationship between DNL and percentage "annoyed" and percentage "highly annoyed" for three transportation-noise sources. Different curves were found for aircraft, road traffic, and railway noise. Table A-2 summarizes their results. Comparing the updated Schultz curve to these results suggests that the percentage of people highly annoyed by aircraft noise may be higher than previously thought. Authors Miedema and Oudshoorn [35] supplemented that investigation with further derivation of percentage of population highly annoyed as a function of either DNL or DENL[3], along with the corresponding 95 percent confidence intervals, and obtained similar results.

Table A-2. Percent Highly Annoyed by Different Transportation-Noise Sources

DNL (dB)	Percent Highly Annoyed (%HA) Air	Road	Rail	Schultz Combined
55	12%	7%	4%	3%
60	19%	12%	7%	6%
65	28%	18%	11%	12%
70	37%	29%	16%	22%
75	48%	40%	22%	36%

As noted by the World Health Organization (WHO), however, even though aircraft noise seems to produce a stronger annoyance response than road traffic noise, caution should be exercised when interpreting synthesized data from different studies [36].

Consistent with the WHO's recommendations, the Federal Interagency Committee on Noise (FICON) considered the Schultz curve to be the best source of dose information to predict community response to noise but recommended further research to investigate the differences in perception of noise from different sources [13].

The ISO update (ISO 1996-1:2016) [37] introduced the concept of Community Tolerance Level (L_{ct}) as the DNL at which 50 percent of the people in a particular community are predicted to be highly annoyed by noise exposure. L_{ct} accounts for differences between sources and/or communities when predicting the percentage highly annoyed by noise exposure. ISO also recommended a change to the adjustment range used when comparing aircraft noise to road traffic noise. The previous edition suggested a +3 dB to +6 dB adjustment range for aircraft noise relative to road traffic noise, while the latest edition recommends an adjustment range of +5 dB to +8 dB. This adjustment range allows DNL to be correlated to consistent annoyance rates when originating from different noise sources (i.e., road traffic, aircraft, or railroad). This change to the adjustment range would increase the calculated percent highly annoyed at 65 dB DNL by approximately 2 percent to 5 percent greater than the previous ISO definition. Figure A-9 depicts the estimated percentage of people highly annoyed for a given DNL using both the ISO 1996-1 estimation and the older FICON 1992 method. The results suggest that the percentage of people highly annoyed may be greater for aircraft noise than previously thought.

[3] DENL is the Day-Evening-Night Average Sound Level, which is similar to CNEL except it has a 5.0 dB adjustment to the evening period. DENL is not used in the U.S.

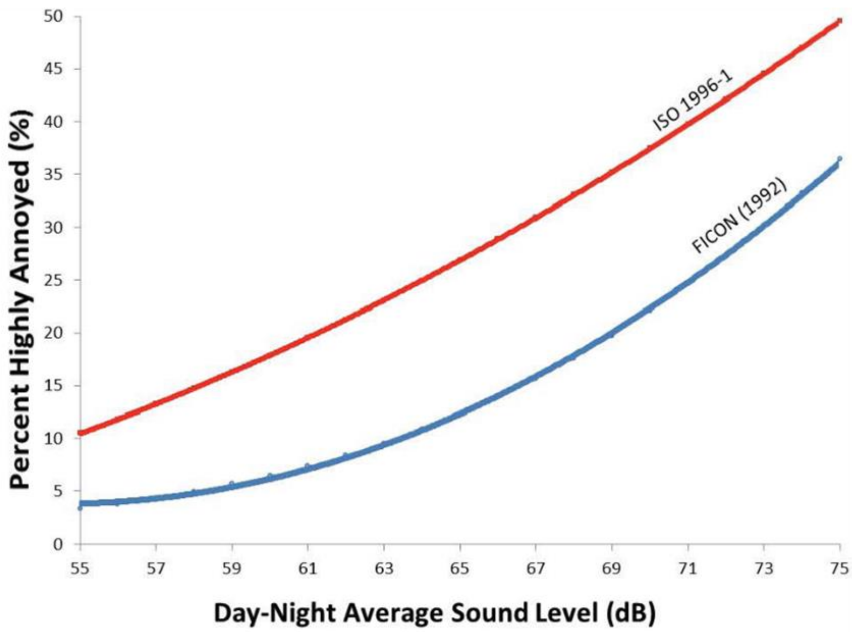


Figure A-9. Percent Highly Annoyed: A Comparison of ISO 1996-1 to FICON 1992

In the 2008 Hypertension and Exposure to Noise near Airports (HYENA) study, annoyance levels due to aircraft noise and road traffic noise were assessed in subjects who lived in the vicinity of six major European airports using the 11-point International Commission on Biological Effects of Noise scale. Exposure-response curves for road noise were congruent with the European Union (EU) standard curves used for predicting the number of highly noise-annoyed subjects, but ratings of annoyance due to aircraft noise were higher than predicted. The study supports findings that people's attitude toward aircraft noise has changed over the years and that the EU standard curve for aircraft noise should be modified [38].

The U.S. Federal Aviation Administration (FAA) has recently conducted a major airport community noise survey at approximately 20 U.S. airports. This study investigated changes to the relationship between aircraft noise and community annoyance [39]. Results from this study found that more people are highly annoyed to aircraft noise exposures compared to previous studies.

In a study related to assessing aircraft noise exposure for people in the surrounding community, the Brisbane Airport in Queensland, Australia, assembled a Health Impact Assessment (Volume D7), which discussed, among other noise effects, annoyance and human response to changes in noise exposure versus steady-state response (Section 7.9 of the report) [26]. The authors suggest there is a difference between the gradual increase in noise exposure and the additive property of increasing noise levels from a particular event. The latter is called a "step change." The Brisbane Health Impact Assessment references Brown and Kamp [40], who have reviewed the literature available on human response to such changes. They observe:

> Most information on the relationship between transport noise exposure and subjective reaction (annoyance/dissatisfaction) comes from steady state surveys at

> sites where there have not been step changes in noise exposure. Environmental appraisals often need to assess the effects of such step changes in exposure and there is growing evidence that when noise exposure is changed, annoyance-ratings may change more than would be predicted from steady state relationships.
>
> Conventional wisdom is that human response to a step change in exposure to transport noise can be predicted from exposure-response curves that have been derived from studies where human response has been assessed over a range of steady-state noise conditions. However, in situations where a step change in transport noise exposure has occurred, various surveys suggest that human response may be different, usually greater, as a result of the increase/decrease in noise, to what would be predicted from exposure-response curves derived under steady-state conditions. Further, there are suggestions that such (over)reaction may be more than a short-term effect. [40]

Guski [41] describes this change effect in a hypothetical model and also notes that where the noise situation is permanently changed, the annoyance of residents usually changes in a way that cannot be predicted by steady-state dose/response relationships. Most studies show an "over reaction" of the residents: with increasing noise levels, people are much more annoyed than would be predicted by steady-state curves, and, with a decrease of noise levels, people are much less annoyed. Guski also notes that the annoyance may change prematurely before the change of levels, with residents expecting an increase in noise levels reacting more annoyed, and residents expecting a decrease in noise levels less annoyed than would be predicted in the steady-state condition.

Brown and Kamp [40] conclude:

> Our review of the literature on response to changes in noise leads us to the conclusion that we cannot discount the possibility that overreaction to a step change in transport noise may occur, and that this effect may not attenuate over time. However, evidence is still inconclusive and based on limited studies that tend not to be comparable in terms of method, size, design and context. Further, our view is that most explanations given in the literature for an overreaction are only partly supported, in some cases not at all, and generally there is conflicting evidence for them. There is still also no accepted view on the mechanism by which annoyance changes in response to a change in exposure. In particular, most explanations are usually post-hoc and the noise change studies have not been designed to test them. [40]

The Brisbane Airport Corporation Health Impact Assessment suggests that the potential for "over-reaction" to stepped changes in noise exists and needs to be recognized; people subject to an increase in noise may experience more annoyance than predicted, while people subject to a decrease in noise may experience less annoyance than predicted. Further, any such over-reaction should not necessarily be assumed to be a temporary phenomenon; evidence from existing studies suggests that it could persist for years after the exposure changes [26].

APPENDIX B DOD AIRCRAFT NOISE MODELS

The DoD utilizes noise modeling and quantitative noise descriptors when analyzing military noise, noise impacts, and compatible land use. The Department of the Air Force, which serves as the lead DoD agency for fixed-wing aircraft noise modeling, maintains several noise modeling programs. Each noise model is designed to support analysis of specific operation types (i.e., subsonic aircraft, supersonic aircraft, ground weapons) and specific uses (i.e., airbase, ranges, supersonic corridors). The two main noise models used for National Environmental Policy Act (NEPA) and Air Installation Compatible Use Zones (AICUZ) studies are NOISEMAP and MRNMAP. The DoD is currently developing a new noise modeling program, the Advanced Acoustic Model, for an eventual replacement of NOISEMAP.

NOISEMAP and MRNMAP noise models are based on scientific principles and measured noise data. The underlying algorithms (calculation procedures and methods) that predict noise propagation are based on theory and empirically derived relationships. NOISEMAP and MRNMAP models have improved with time as computer power has increased and as our understanding of physical acoustics has improved. The usefulness of these noise models lies in the flexibility they give an analyst to assess the noise levels in various scenarios over a large area of interest (e.g., airfields and their surrounding communities and training areas). A model allows comparison of the advantages and disadvantages of a defined set of operations, along with many alternatives, in order to determine what scenario best minimizes the noise impacts on the environment while still meeting the Navy's training goals.

B.1 NOISEMAP

NOISEMAP is a suite of computer programs that work in concert to predict the noise exposure from aircraft flight, maintenance, and ground run-up operations.

The suite of programs is:

- BASEOPS Version 7 [42]– graphical user interface for data entry
- NOISEFILE – noise database
- OMEGA10 [43] – calculates sound vs distance for aircraft flight operations
- OMEGA11 [43] – calculates sound vs distance for ground maintenance and run-up operations
- NMAP Version 7.3a [44] – calculates noise exposure values on the ground
- NMPLOT [45] – converts calculated noise exposure values to noise contour plots

NOISEFILE is the DoD noise database originating from noise measurements of controlled flyovers at prescribed power, speed, and drag configurations for many models of aircraft.

The data input module BaseOps allows the user to enter the runway coordinates, airfield information, flight tracks, and flight profiles along each track by each aircraft, numbers of flight operations, run-up coordinates, run-up profiles, and run-up operations. After the operational parameters are defined, NOISEMAP calculates DNL or CNEL values on a grid of ground locations on and around the facility.

The NOISEMAP computer program "flies" each aircraft along a defined flight trajectory, using the power, speed, and altitude profiles defined for each takeoff, landing, or closed-loop pattern operations. This is accomplished by specifying the flight track and flight profile. The flight track is a projection onto the ground plane of the three-dimensional flight path of the aircraft; the flight profile defines the performance characteristics of the aircraft in terms of altitude, speed, and power versus distance from the start of the flight track. The noise levels of a specific aircraft (or class of aircraft) at a given thrust are defined as a generalized function of the slant distance between the aircraft and the observer. The path of the aircraft in space is defined in the input data set so that the slant distance between the aircraft and observer is known. The noise level versus distance data are used to determine the sound exposure level (SEL) at a specific ground location for a single operation. The program computes the noise exposure from each aircraft flight at a gird of points on the ground. The noise exposure (primarily defined as DNL or CNEL) at a ground location resulting from aircraft flight operations is a function of the SEL produced by the individual aircraft and the number of such aircraft operating during daytime/evening/nighttime periods. The total aircraft flight noise exposure is the summation of the noise exposure from all operations of all aircraft on all flight paths.

NOISEMAP also computes noise exposure due to maintenance and preflight ground run-up operations. The is accomplished by specifying the run-up locations and run-up engine power profiles. The run-up profile defines the characteristics of an engine run-up in terms of power settings and duration at each setting, magnetic heading of the aircraft, and degree of noise suppression, if any. The noise level of a specific engine/aircraft combination at a given thrust are defined as a generalized function of the slant distance and directivity angle between the run-up location and the observer. The noise level versus distance and angle data are used to determine the A-weighted sound level at a specific ground location for a single run-up. The program computes the noise exposure from each run-up at a grid of points on the ground. The DNL or CNEL at a ground location resulting from aircraft ground run-up operations is a function of the A-weighted sound level produced by the individual run-ups, the duration of the individual run-ups, and the number of operations occurring during daytime/evening/nighttime periods.

The NMPlot program draws contours of equal DNL for overlay onto land-use maps. For noise studies, as a minimum, DNL contours of 65, 70, and 75 dBA are developed. NOISEMAP also has the flexibility of calculating sound metrics (e.g., SEL, $L_{Aeq,24hr}$, and DNL) at specified points so that noise values at representative locations around an airfield can be described in more detail.

NOISEMAP is most accurate for comparing "before-and-after" community noise effects, which would result from the implementation of proposed changes or alternative noise control actions when the calculations are made in a consistent manner. NOISEMAP allows predicting noise levels for the proposed action prior to implementing the action. The noise modeling results of these computer programs, along with noise impact guidelines, provide a relative measure of noise effects around aircraft operating facilities.

B.2 MRNMAP

MRNMAP, known as the Military Operations Area (MOA) Range NOISEMAP, calculates noise exposure levels under special use airspace such as restricted areas, MOAs, military training routes (MTRs), and ranges. The United States Air Force developed this general-purpose computer model for calculating noise exposures occurring away from airbases, since aircraft noise is also an issue within MOAs and ranges, as well as along MTRs. This model expands the calculation of noise exposures away from airbases by using algorithms from both NOISEMAP [46] and ROUTEMAP [47].

MRNMAP uses two primary noise models to calculate the noise exposure: track and area operations. Track operations are for operations that have a well-defined flight track, such as MTRs, aerial refueling, and target bombing tracks. Area operations are for operations that do not have well defined tracks, but occur within a defined area, such as air-to-air combat within a MOA.

MRNMAP inputs have two major components: the airspace components (segments) and the aircraft flight parameters. The airspace components differ between track operations and aera operations. For track operations, the airspace components include the track segment width and the aircraft altitude. Additionally, the distributions of operations along the track may be specified; a narrow distribution may be representative of bombers using electronic navigation while a widely dispersed distribution may be representative of tactical aircraft using visual navigation and terrain masking. For area operations, the airspace components are flexible and depend on how the airspace is utilized. If little is known about the airspace utilization within a MOA, then the MOA boundaries are used, and the operations are uniformly distributed within the defined area. However, if more is known about how and where the aircraft fly within the MOA, subareas can be defined within the MOA to model the noise exposure more accurately. The aircraft flight operational parameters for track and aera operations are primarily defined by altitude, speed, and power, but the values for these parameters may differ based on the route type (e.g., visual, instrument, etc.).

MRNMAP calculate noise exposure by combining the airspace and aircraft operational inputs. The program can calculate cumulative exposure metrics like DNL and CNEL, however, the Onset Rate-Adjusted Monthly Day-Night Average Sound Level (L_{dnmr}) is the recommended metric since it accounts for the potentially high onset rates of the aircraft noise and sporadic nature of the operations.

B.3 Operational Data Used by NOISEMAP and MRNMAP

Both NOISEMAP and MRNMAP require accurate descriptions of the operations being modeled. The number of operations used by the NOISEMAP model is based on the average annual day, per DoD Instruction 4715.13 [5]. The average annual day represents the average number of daily airfield operations that would occur during a 24-hour period based on 365 flying days per year; the average annual day is calculated by dividing the total annual airfield operations by 365. The number of operations used by the MRNMAP model is based on the average number of operations per year. The timespan of 1 year is used to account for the sporadic nature of the training events away from airfields.

B.4 Incorporation of Weather in Noise Modeling

Atmospheric conditions, such as wind and temperature, can cause large variations in real-time received sound from day to day. Airfield noise modeling, including NOISEMAP and MRNMAP, considers long-term averages of the acoustical environment. Thus, NOISEMAP calculations assume more favorable conditions for the propagation of sound and, in so doing, these calculations tend to the higher range of potential received sound levels [6]. For example, even though NOISEMAP does not include the effect of wind explicitly, it assumes for purposes of prediction that sound travels downwind, which is the most favorable condition for sound levels to be higher at a receiver location. For this reason, the model is expected to over-predict sound levels.

B.5 Ground Terrain in Noise Modeling

NOISEMAP uses a lateral attenuation curve to develop the noise versus distance relationship for ground-to-ground propagation. This lateral attenuation curve (shown in Figure B-1) includes the influence ground absorption as well as other factors for aircraft overflights. When an aircraft is near or on the ground, the lateral attenuation is 8.1 dB. As an aircraft gains altitude, the elevation angle to a receiver increases, and the attenuation decreases quickly. At an elevation angle of 12°, the attenuation is only 1 dB. At an elevation angle of 45° the attenuation goes to 0 dB.

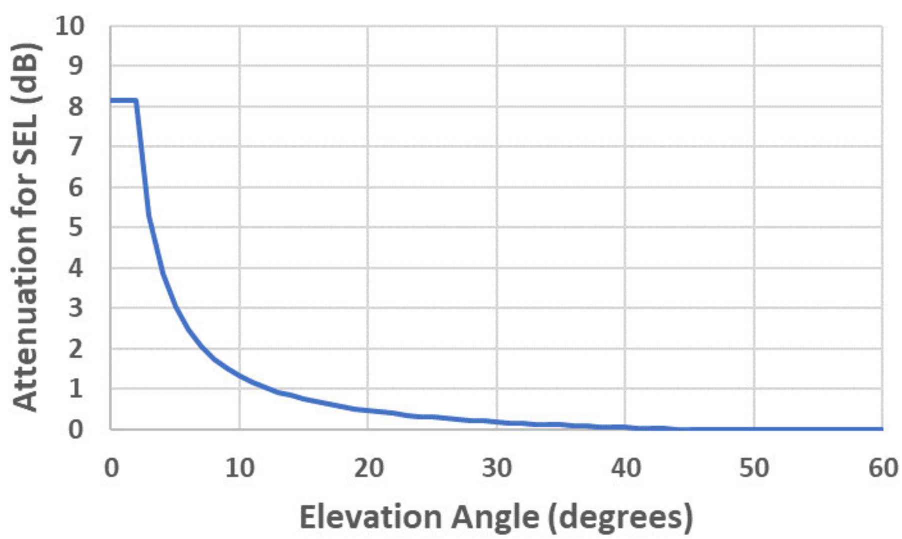


Figure B-1. NOISEMAP's Lateral Attenuation Curve

NOISEMAP has two modes for accounting for ground cover and terrain. The first mode assumes a flat-earth coordinate system. This assumption was part of the original formulation for the computational design and is included in the lateral attenuation curve in Figure B-1.

The second mode considers both ground cover and ground elevation variations. Ground cover variations are handled with a hard/soft binary characterization of the ground surface. Generally, ground is modeled as prepared grass fields (soft), which has additional absorption, and water surfaces are modeled as hard with no additional absorption. The effect of this variation allows sound to propagate further over water surfaces compared to ground surfaces. This mode does not include any propagation effects from other ground cover types such as forests.

In addition to the effect of ground cover, this mode also includes the effect of variations in ground elevation along the path from the source to the receiver. NOISEMAP classifies these variations as terrain cuts into the following groups: flat, valley, and hill. These representative terrain cuts are show in Figure B-2. The attenuation for each terrain cut type is based on semi-empirical A-weighted curves developed with comparison to full spectral calculations. The ground cover and elevation adjustments are applied to the noise versus distance relationship.

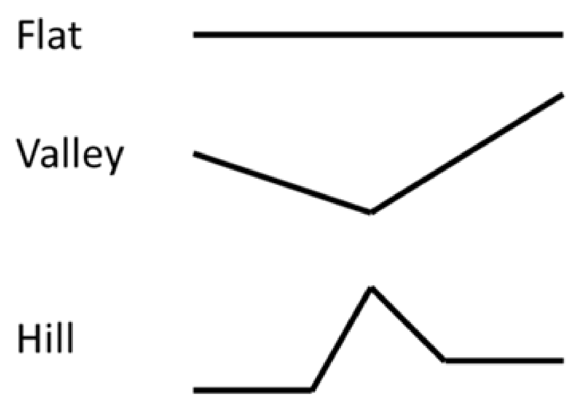


Figure B-2. NOISEMAP Terrain Cut Models for Topography Attenuation Calculation

B.6 DoD Noise Model Data: NOISEFILE

B.6.1 Reference Source Noise

The reference source data for NOISEMAP is referred to as NOISEFILE, which contains two separate datasets: flyover and ground run-up noise. For the flyover data (Flight01.dat), two to seven reference engine power conditions are included for each aircraft. For each reference condition, seven integrated metrics are included: Perceived Noise Level (PNL), tone-corrected PNL, Maximum A-weighted Sound Level (L_{Amax}), tone-corrected L_{Amax}, Effective Perceived Noise Level (EPNL), Sound Exposure Level (SEL), and tone-corrected SEL. Also, for each reference condition, a one-third octave (OTO) band spectrum is included. This spectrum is the average spectrum that occurs at a maximum PNL for a flyover. In addition to the noise data, the following associated operational data are included: engine power settings, engine power extrapolation limits, airspeed, vehicle configuration, number of measurements, angle of maximum PNL and date of analysis. These reference data normally are directly measured during dedicated flight tests in which each engine condition is repeated two to six times. From these repeated measurements, the data are averaged and normalized to 1,000 ft and US Standard Atmospheric Conditions of 59°F and 70 percent relative humidity. One technical issue with the measured data is that the noise is collected at 5 ft (1.5 m), so the receiver height is convolved with the reference data.

For the ground run-up data (Static01.dat), two to seven engine power conditions are included for each aircraft. The noise data are provided as OTO band spectra from 10 to 10k Hz in 10° steps from 0° to 180°. The reference distance for the ground run-up noise data is 250 ft as this distance is the standard distance used for the measurements. Ground run-up data are required for military aircraft since the data are used for the take-off roll for modeling departure flight operations.

If a military aircraft does not have measured noise data, then its reference noise data are estimated from measured surrogates based primarily on engine type and airframe configuration. These surrogates are noted in Flight01.dat and Static01.dat.

NOISEFILE also includes civilian aircraft flyover data, which were translated from the Integrated Noise Model (INM). These civilian data include four integrated metrics: L_{Amax}, EPNL, SEL and tone-corrected SEL and an OTO band spectrum from a spectral class (50 to 10k Hz). The associated data includes engine power settings and interpolation type, extrapolation limits, airspeed, and configuration. They are also normalized to 1,000 ft and US Standard Atmospheric Conditions of 59°F and 70 percent relative humidity.

B.6.2 Noise Versus Distance Curves (NvDC)

The development of the NvDC for flight noise involves the OMEGA10 module that generates two curves for the following metrics: SEL, EPNL, L_{Amax}, and tone-corrected PNL. One curve is for Air-to-Ground propagation (AG), and the other is for Ground-to-Ground propagation (GG). The AG curves include losses due to geometric spreading and atmospheric absorption. The GG curve adds in losses from ground attenuation. The atmospheric absorption is based on the Society of Automotive Engineers Aerospace Recommended Practice 866A, "Standard Values of Atmospheric Absorption as a Function of Temperature and Humidity", which is now outdated. The selected atmospheric conditions are based on the 6th absorptive month out of 12 monthly average values of temperature and relative humidity. These values are applied to the OTO spectrum for the selected engine power condition. If the selected condition is not a reference condition, then the spectrum is a linear interpolation between the two reference engine power conditions. If it is outside the reference values, then it is an extrapolation from the nearest reference set as long as it is within the extrapolation limits. If it is outside the limits, then the engine power condition is changed to the extrapolation limit value. The NvDC do not include directivity as directivity is convolved in the integrated metrics in the measurement of the noise data.

For ground run-up operations, the NvDC are generated by the OMEGA11 module that generates a series of curves for the following metrics: L_{Amax} and tone-corrected PNL. The NvDCs include losses from geometric spreading, atmospheric absorption, and ground attenuation, and they are directional with NvDCs from 0° to 180° in 10° steps.

APPENDIX C DEPARTMENT OF DEFENSE NOISE STUDIES PROCESS

The Department of Defense (DoD) regularly produces modeled noise studies as components of larger environmental studies and planning documents. The two most common studies undertaken by the DoD are driven by the National Environmental Policy Act (NEPA) and the DoD's own Air Installation Compatible Use Zones (AICUZ) program.

The noise study process for the Navy is defined in DoD Instruction 4715.13 [5]. This document defines associated procedures and resources for each step in the noise study modeling process. This process supports modeled noise studies conducted as part of environmental and planning studies for NEPA and the AICUZ program, respectively.

A noise study is defined by specific phases:

- Definition of a noise study's scope
- Collection of operational data with interview of airfield operations
- Validate Operational Modeling Data Package
- Calculation of noise exposure via noise modeling programs
- Report on noise exposure values via noise contour maps
- Supplemental noise analysis at points of interest within the study area
- Public release of results and data used in the development of the noise study

C.1 Definition of a Noise Study's Scope

A noise scope is most commonly based on the scope of any proposed change to airfield operations. Thus, depending on the scope of the activity, the study may involve multiple scenarios at a single airfield, or multiple homebases and auxiliary airfields.

C.2 Data collection

The data collection process involves a pre-site visit data request, an on-site visit that involves interviews with base personnel, and follow up communications for data that could not be obtained during the on-site visit.

C.2.1 Pre-site Visit Data Request

Data collection for a noise study begins with requesting previous noise study modeling data and reports. The previous noise study modeling data is used as a starting point for deriving the aircraft operational data, flight tracks, and flight profiles. All data from the previous analysis is updated or verified through the data collection, interview, and data validation process. Additional data requested before the on-site visit includes the previous 5 years of Air Traffic Activity Reports from the Air Traffic Control (ATC) personnel and Airspace Utilizations Report from Airspace Managers. These data contain the annual numbers of military, air carrier/air taxi, and general aviation flight operations at the airfield and the number of annual sorties within an airspace unit, respectively. Points of Contact (POC) for pilots and maintainers are requested for each flying squadron and maintenance squadron, respectively. Emails are sent to these POC requesting annual operations for their squadron and asking them to be prepared during the on-site interviews to answer a set of questions relating to operational data, airspace utilizations, flight tracks, and flight profiles for the pilots of the flying squadrons, and annual maintenance/aircraft run-up events and types of events along with operational run-up details for the maintenance squadron personnel.

C.2.2 On-site Visit and Interviews

The on-site interviews are conducted by a noise analyst. The noise analyst is trained in the noise study process and can conduct an interview that will gather the information required to run the noise modeling programs.

During the on-site visit, the noise analyst interviews:

- At least one pilot of each flying squadron
- A maintenance POC who is familiar with the annual number and type of maintenance events and the engine run-up details of each event type
- ATC and the airport manager
- The airspace manager.

For the pilot interview, the operational data requested includes annual sorties, number of patterns per sortie, types of operations and percentages of each operation type, percentages of operation types during acoustic night (22:00-07:00), runway utilization (if known), flight tracks for each operation type and annual percentages on each flight track for each runway and operation type, flight profile information including altitude, airspeed, engine power, and operating configuration at specific points along each flight track, and engine run-up information including types of engine run-ups, duration, engine power settings, and heading. If the noise study involves airspace noise analysis, additional data is requested for the number of annual airspace events for each mission type, mission operational parameters including average duration, engine power and airspeed for each mission type, and altitude band distributions for each mission type.

For the maintenance personnel interview, the data requested includes types of maintenance engine run-up events and number of annual events of each maintenance type, average duration at each engine power setting for each type of engine run-up, locations for the run-up events and utilization percentages at these locations, and finally heading of the aircraft at each of the run-up locations.

For the ATC and airport manager interview, aircraft flight tracks are reviewed or derived, and airport flight procedures are discussed. The annual number of transient aircraft operations and types of operations are requested including transient aircraft pattern operations.

If the noise study includes airspace noise analysis, the airspace manager is interviewed. This interview involves receiving airspace parameters such as boundary latitude and longitude coordinates and floor and ceiling altitudes. Also, 5 years of airspace utilization logs are requested, and these logs will generally have monthly numbers of each aircraft type and aircraft squadron that utilize the managed airspaces.

C.2.3 Post-site Visit Follow Up

After the on-site interviews, there will often be a need for further communication to fill in any data gaps in the noise analysis. After all data required for the noise modeling is received, the operational data will be assembled into worksheets within a spreadsheet. Multiple tabs are used to obtain specific data for each of the operational data types, and these data types include annual airfield operations, runway utilization, aircraft flight operation types, percentages of operations during acoustic day (07:00-22:00) vs acoustic night (22:00-07:00), traffic flow utilization, and maintenance events. Formulae link all of the operational data together to establish the operational data entered into a NOISEMAP case.

C.3 Validation of the Operational Modeling Data Package

The data validation package includes this operational data assembled into worksheets within a spreadsheet file along with graphics of the aircraft flight tracks and aircraft flight profiles. This validation package is sent to each POC from the on-site interviews for their input and review. After the data validation package is reviewed and edits are made, the validated data is entered into the noise modeling software.

C.4 Calculation of Noise Exposure Via Noise Modeling Programs

The validated aircraft operational data, flight tracks, and flight profiles from the approved validation package are inputted into the DoD approved noise models (see Appendix B for descriptions of these models). The noise model outputs DNL noise contours, and these contours can be used to determine potentially significant areas of noise impacts. Additional supplemental metrics are computed at points of interest surrounding an airfield. These supplemental metrics include various methods to evaluate indoor and outdoor speech interference, potential hearing loss, residential nighttime sleep disturbance, and classroom learning disruption. These supplemental metrics are not required for all DoD nose studies.

C.5 Report on Noise Exposure

A final report is prepared at the end of the noise study process. The report is comprehensive and includes details on:

- The purpose of the noise study
- The operational data inputs to the noise models
- All modeled aircraft flight tracks and flight profiles
- The noise models used for the noise study
- The noise metrics, like DNL, calculated by the noise models
- Supplemental metrics at points of interest
- A list of the flight profiles that are the top contributors to the DNL at each point of interest

Any assumptions used in the noise study or transient aircraft substitutions are also presented in the report. The operational data is provided in tables while the results are presented as DNL noise contours.

C.6 Public Release

The Navy typically releases the final report for the noise study to the public via multiple outlets including a public-facing government website and local institutions, like public libraries, in the communities near the airfield or airspace.

APPENDIX D SEL COMPARISON PLOTS

D.1 NAS Whidbey Island

Eight SEL comparison cases were examined. Table D-1 identifies the Site ID and Name under examination and the list of flight profiles that contributed to the comparison. The following figures shows a box chart plot representing the extent of the ***real-time measured data*** with a scatter plot overlayed on top that shows the SEL value predicted by NOISEMAP for the flight profiles involved in the comparison.

Table D-1. SEL Comparison Case Number, Site ID, and Profile IDs for NAS Whidbey Island

SEL Comparison Case Number	Site ID and Name	Aircraft	Profile IDs
1	9B_SG - NASWI Gate	EA-18G	228A_EXP, 228A_FLT, 228A_FRS, 228B_EXP, 228B_FLT, 228B_FRS, 228C_EXP, 228C_FLT, 228C_FRS, 229B_EXP, 229B_FLT, 229B_FRS, 229C_EXP, 229C_FLT, 229C_FRS
2	3A_T - Skagit River Dike	EA-18G	230A_EXP, 230A_FLT, 230A_FRS
3	3A_T - Skagit River Dike	EA-18G	231B_EXP, 231B_FLT, 231B_FRS
4	3A_T - Skagit River Dike	EA-18G	239C_EXP, 239C_FLT, 239C_FRS, 240C_EXP, 240C_FLT, 240C_FRS
5	8B_SG - Dog Park	EA-18G	239C_EXP, 239C_FLT, 239C_FRS, 240C_EXP, 240C_FLT, 240C_FRS
6	3A_T - Skagit River Dike	EA-18G	245_EXP, 245_FLT, 245_FRS
7	2B_T - Seaplane Base	EA-18G	207A_EXP, 207A_FLT, 207A_FRS, 208A_EXP, 208A_FLT, 208A_FRS, 209A_EXP, 209A_FLT, 209A_FRS
8	2B_T - Seaplane Base	EA-18G	210A_EXP, 210A_FLT, 210A_FRS, 211A_EXP, 211A_FLT, 211A_FRS, 212A_EXP, 212A_FLT, 212A_FRS

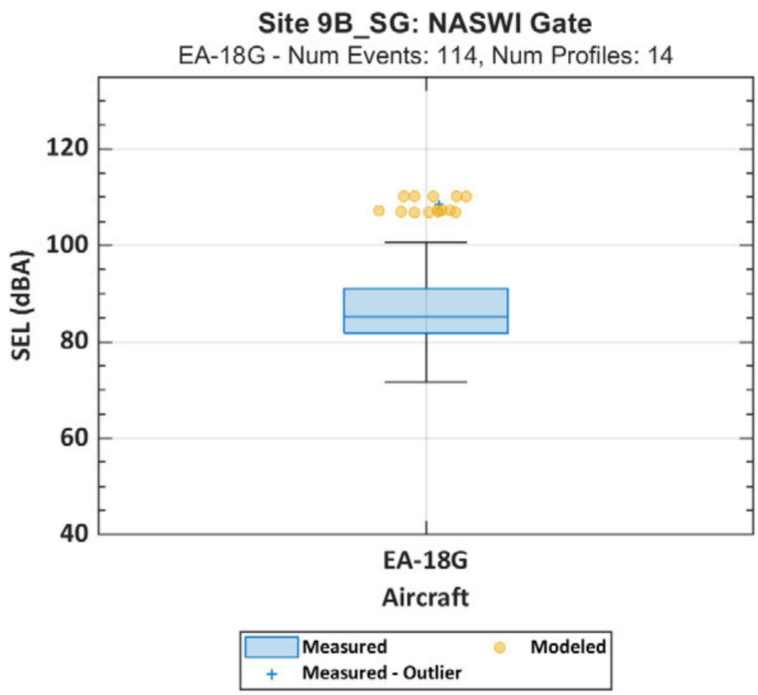


Figure D-1. NAS Whidbey Island Comparison Case 1

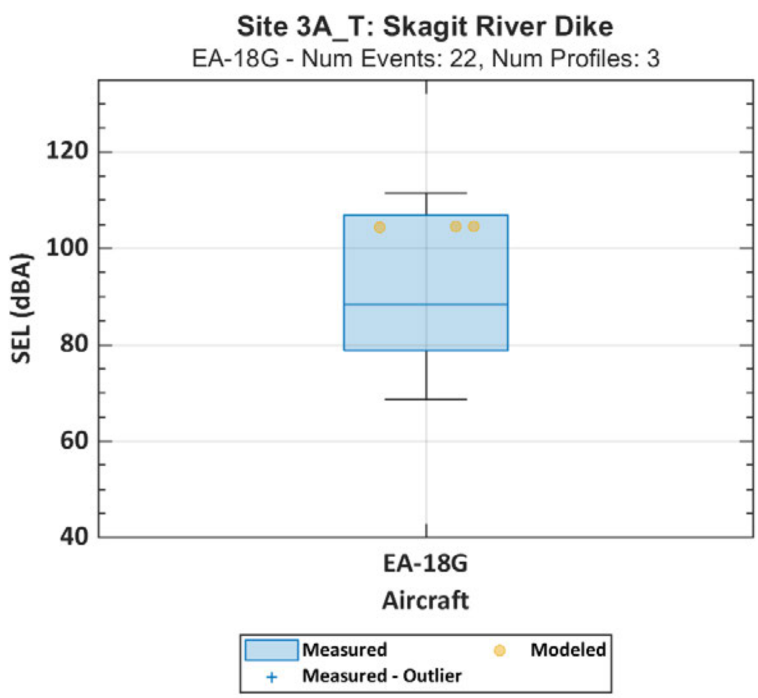


Figure D-2. NAS Whidbey Island Comparison Case 2

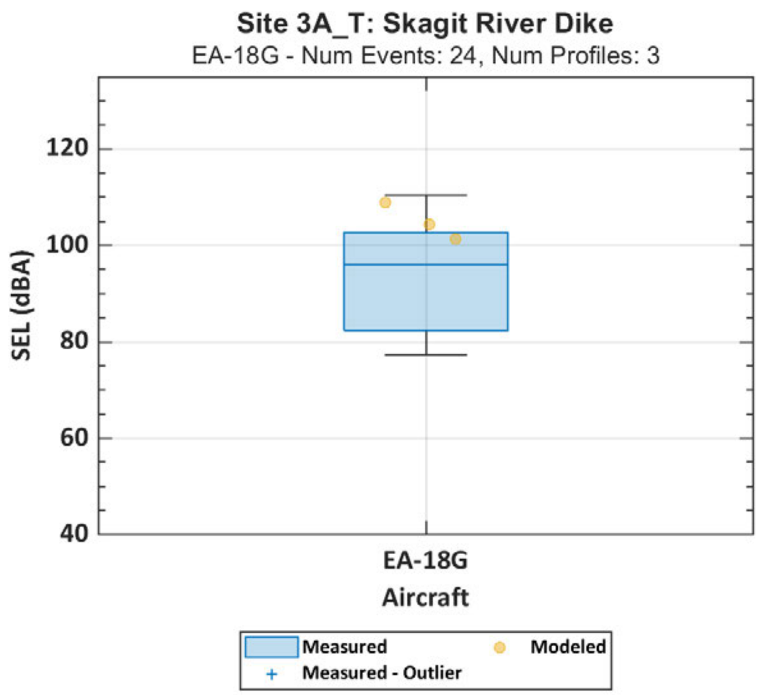


Figure D-3. NAS Whidbey Island Comparison Case 3

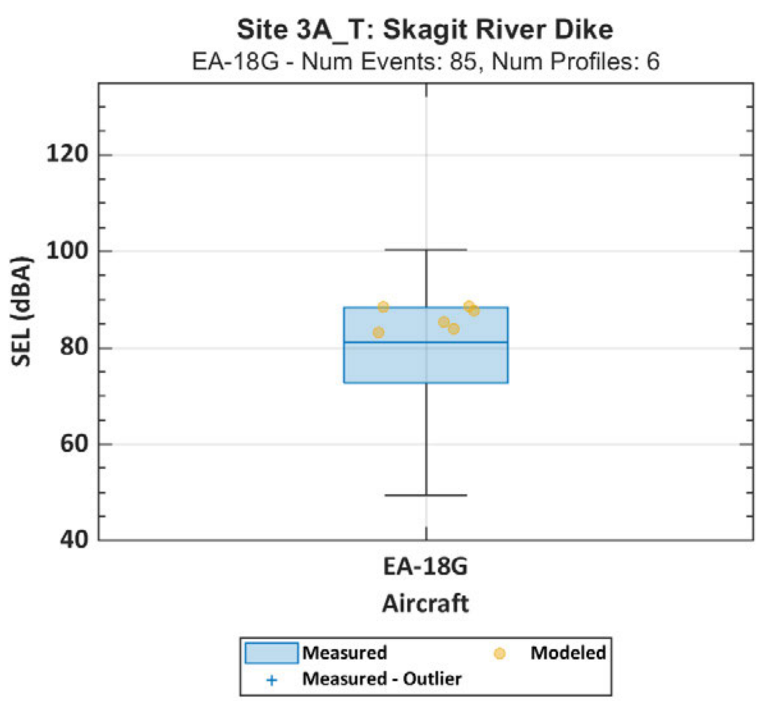


Figure D-4. NAS Whidbey Island Comparison Case 4

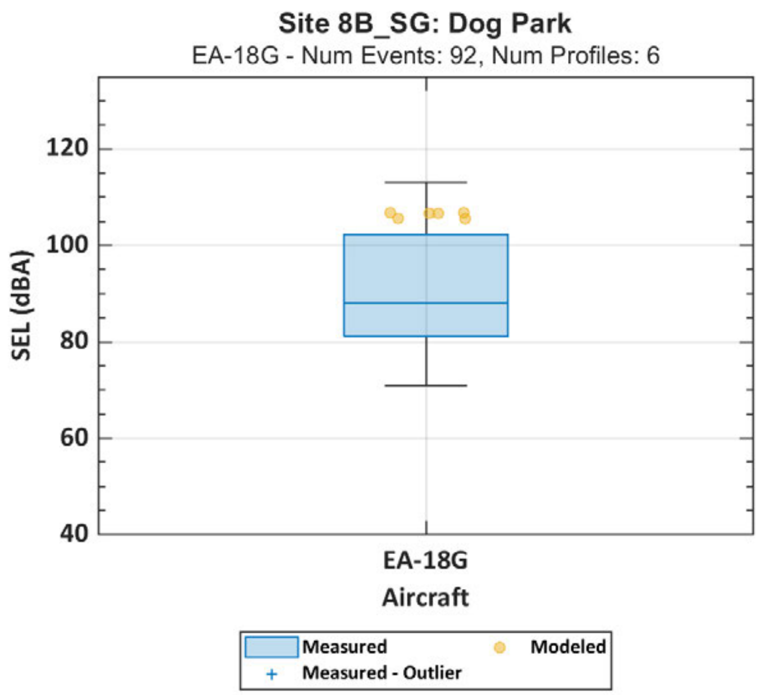


Figure D-5. NAS Whidbey Island Comparison Case 5

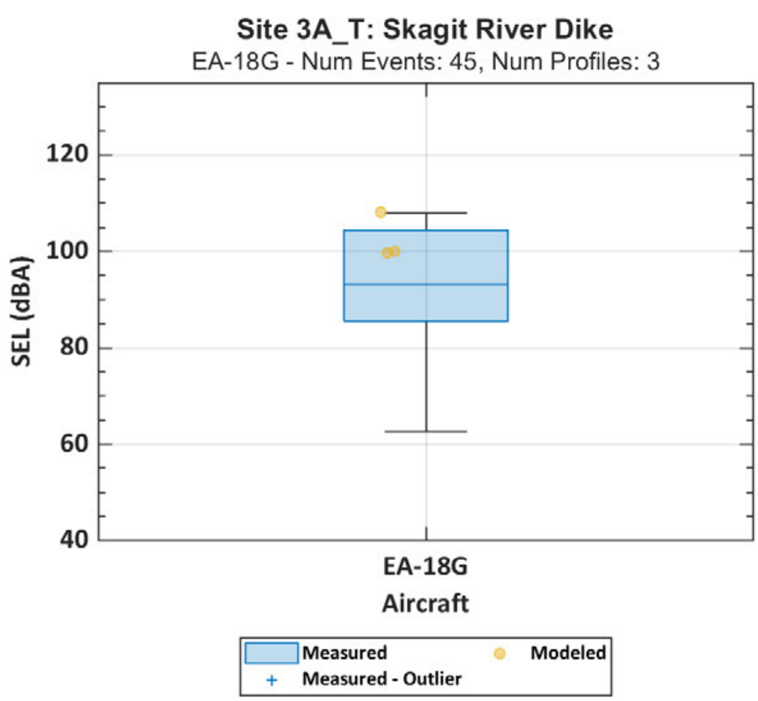


Figure D-6. NAS Whidbey Island Comparison Case 6

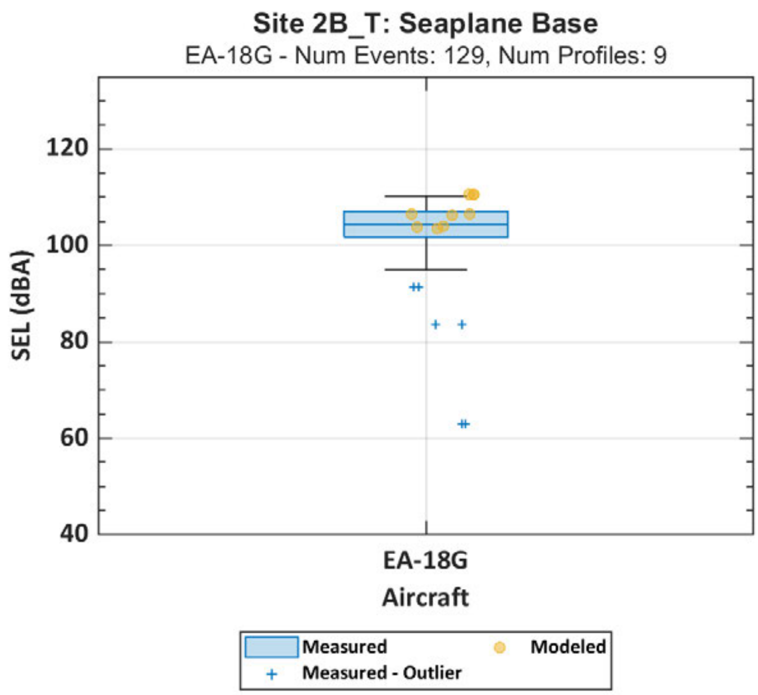


Figure D-7. NAS Whidbey Island Comparison Case 7

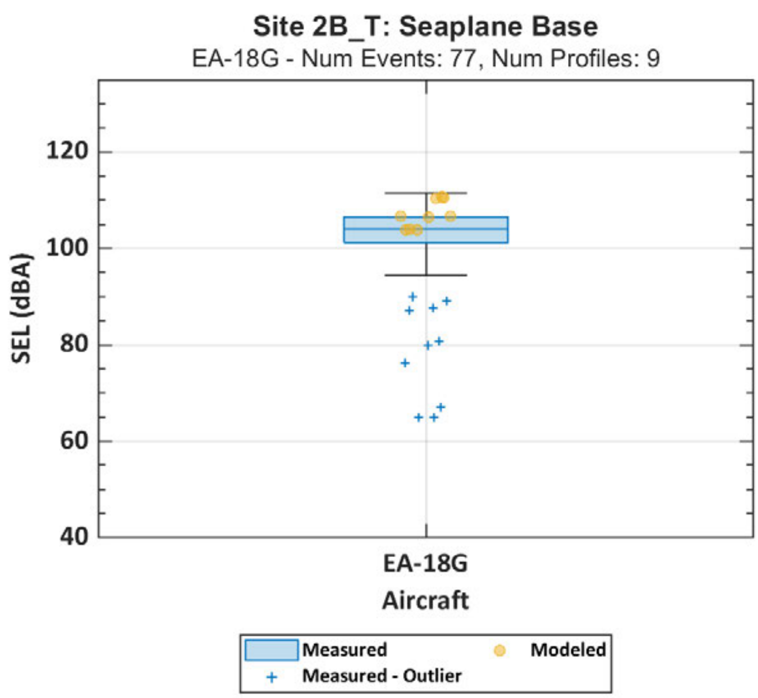


Figure D-8. NAS Whidbey Island Comparison Case 8

D.2 NAS Lemoore

Eighteen SEL comparison cases were examined. Table D-2 identifies the Site ID and Name under examination and the list of flight profiles that contributed to the comparison. The following figures shows a box chart plot representing the extent of the ***real-time measured data*** with a scatter plot overlayed on top that shows the SEL value predicted by NOISEMAP for the flight profiles involved in the comparison.

Table D-2. SEL Comparison Case Number, Site ID, and Profile IDs for NAS Lemoore

SEL Comparison Case Number	Site ID and Name	Aircraft	Profile IDs
1	16_T_LF - NASL Landfill	F/A-18E/F	330_FLT
		F-35C	530_FRS
2	21_T - NASL Runway End	F/A-18E/F	330_FLT
		F-35C	530_FRS
3	21_T - NASL Runway End	F/A-18E/F	331_FLT
4	9_T - Open Sky Ranch	F/A-18E/F	332_FLT
		F-35C	532_FRS
5	6_T_N2 - L & J Vanderham Dairy	F/A-18E/F	332_FLT
		F-35C	532_FRS
6	16_T_LF - NASL Landfill	F/A-18E/F	341_FLT, 342_FLT
		F-35C	541_FRS, 542_FRS
7	16_T_LF - NASL Landfill	F/A-18E/F	343_FLT, 344_FLT
		F-35C	543_FRS, 544_FRS, 545_FRS
8	16_T_LF - NASL Landfill	F/A-18E/F	347_FLT
		F-35C	546_FRS, 547_FRS, 548_FRS
9	15_T - Duck Pond	F/A-18E/F	350_FLT, 351_FLT
		F-35C	549_FRS, 550_FRS, 551_FRS
10	2_T - NASL Radar	F/A-18E/F	356_FLT, 357_FLT, 359_FLT, 360_FLT, 362_FLT, 363_FLT, 365_FLT, 366_FLT, 368_FLT, 369_FLT, 371_FLT, 372_FLT, 374_FLT, 375_FLT, 377_FLT, 378_FLT
		F-35C	556_FRS, 559_FRS, 562_FRS, 563_FRS, 565_FRS, 566_FRS, 569_FRS, 571_FRS, 574_FRS
11	4_T - Polk House	F/A-18E/F	305_FLT
12	6_T_N2 - L & J Vanderham Dairy	F/A-18E/F	306_FLT
		F-35C	506A_FRS

SEL Comparison Case Number	Site ID and Name	Aircraft	Profile IDs
13	6_T_N2 - L & J Vanderham Dairy	F/A-18E/F	308_FLT
		F-35C	508A_FRS
14	9_T - Open Sky Ranch	F/A-18E/F	308_FLT
		F-35C	508A_FRS
15	19_T_GC - Surf Ranch	F/A-18E/F	315_FLT
16	15_T - Duck Pond	F/A-18E/F	430_FLT
		F-35C	630_FRS
17	20_B - College Child Center	F/A-18E/F	431_FLT
		F-35C	631_FRS
18	21_T - NASL Runway End	F/A-18E/F	440_FLT

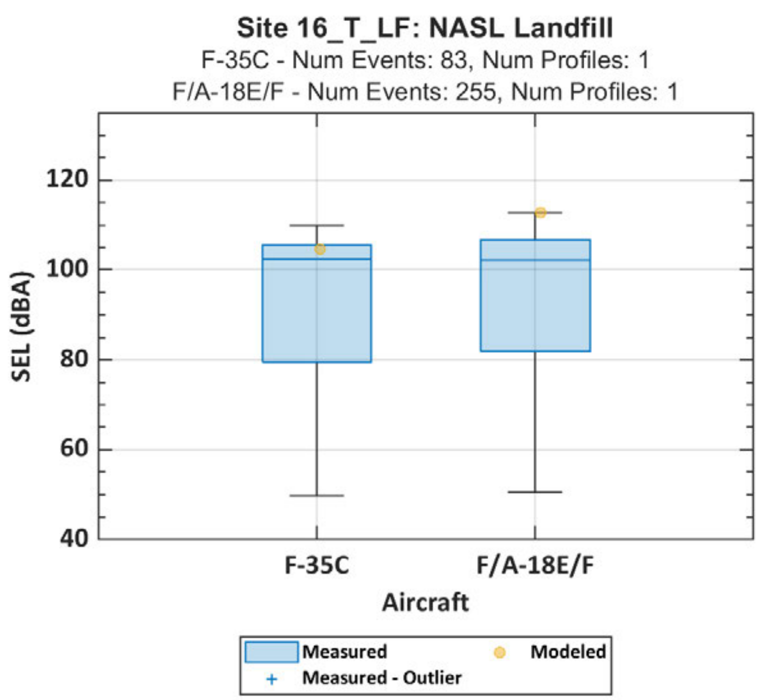


Figure D-9. NAS Lemoore Comparison Case 1

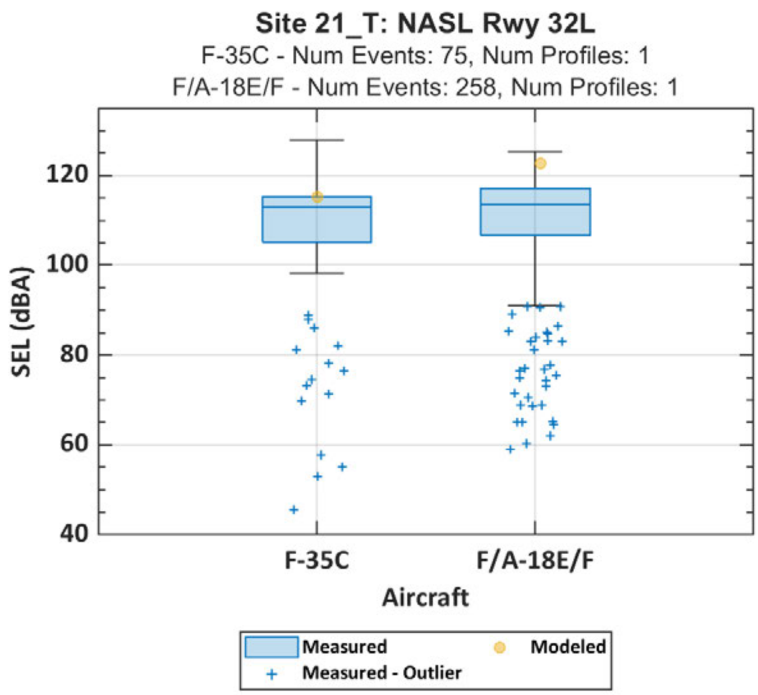


Figure D-10. NAS Lemoore Comparison Case 2

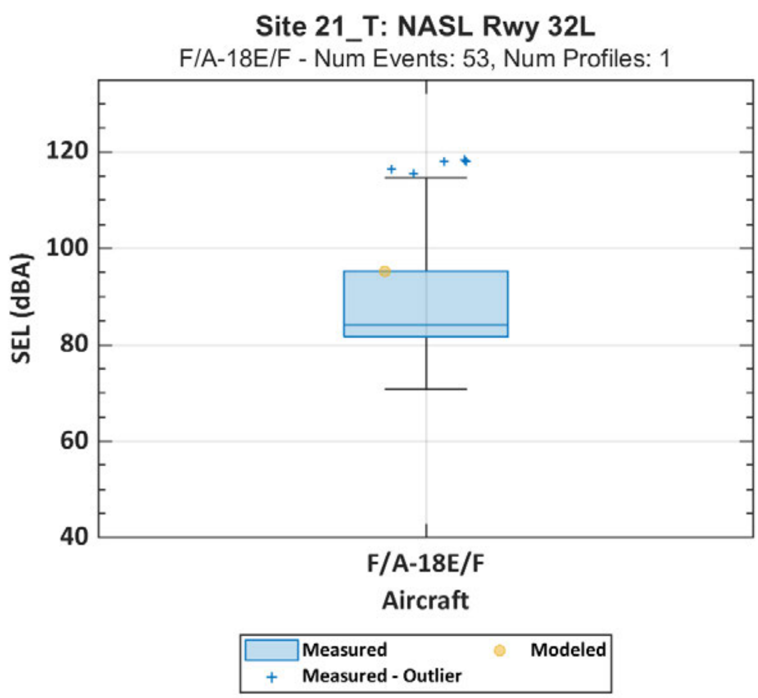


Figure D-11. NAS Lemoore Comparison Case 3

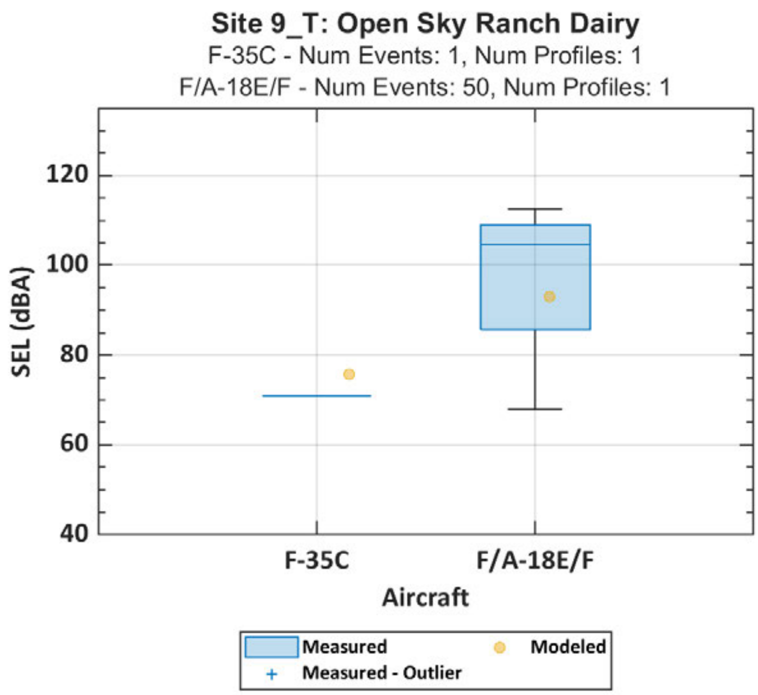


Figure D-12. NAS Lemoore Comparison Case 4

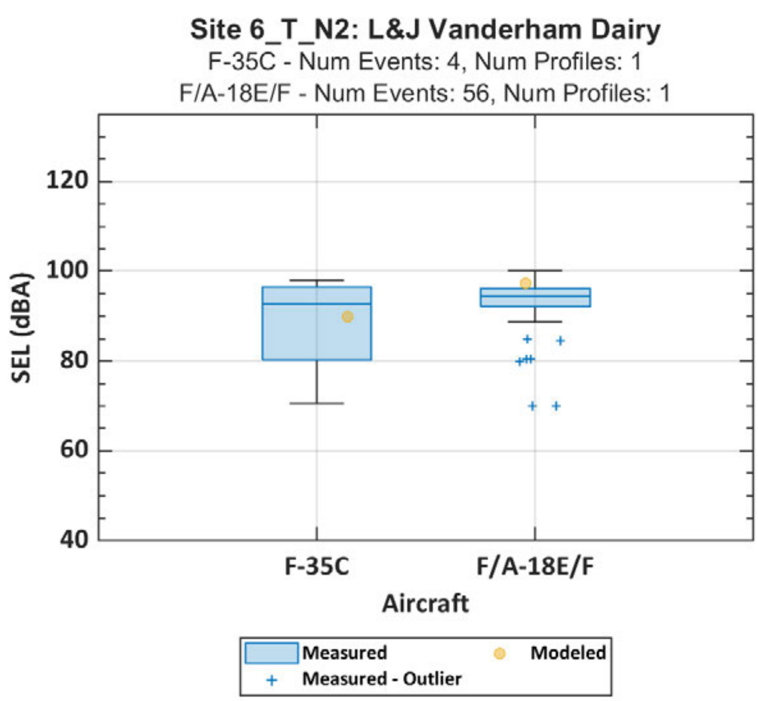


Figure D-13. NAS Lemoore Comparison Case 5

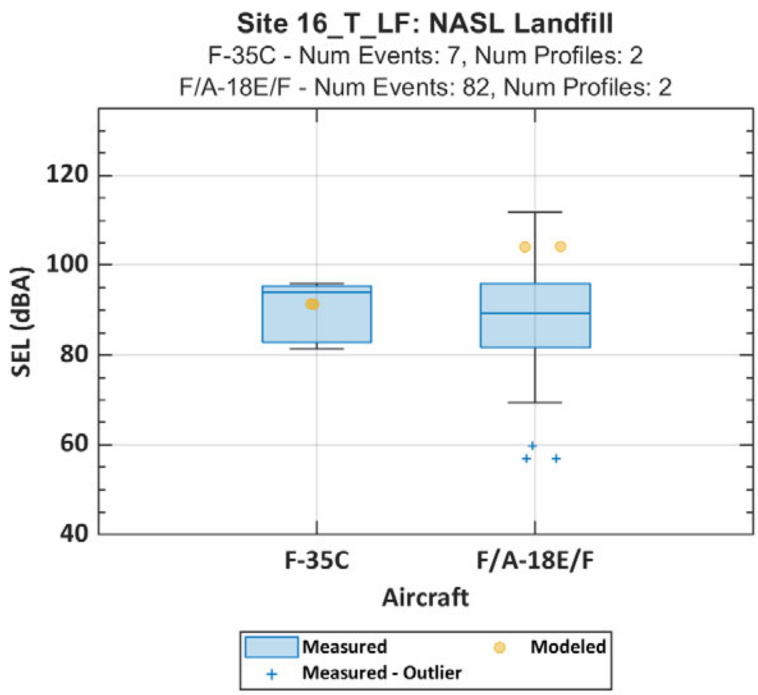


Figure D-14. NAS Lemoore Comparison Case 6

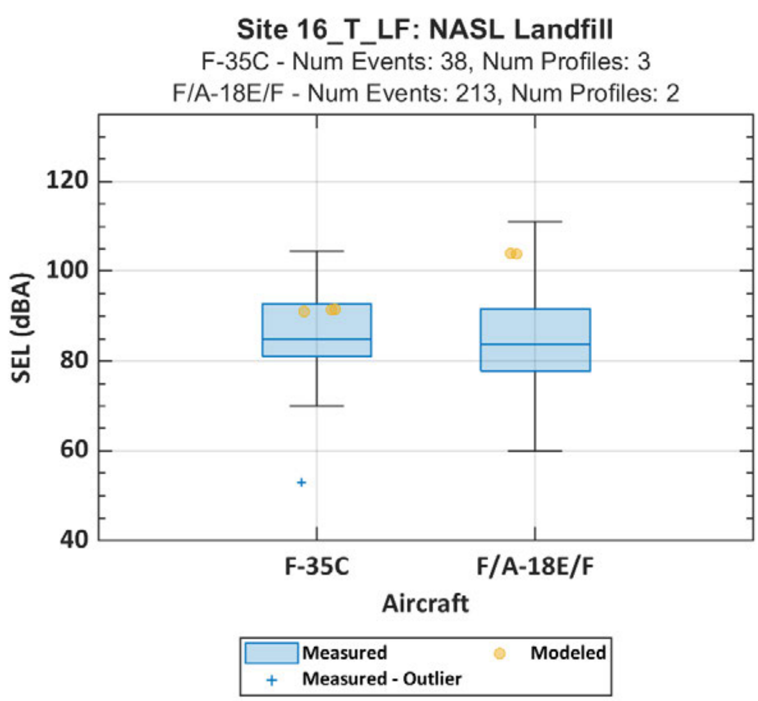


Figure D-15. NAS Lemoore Comparison Case 7

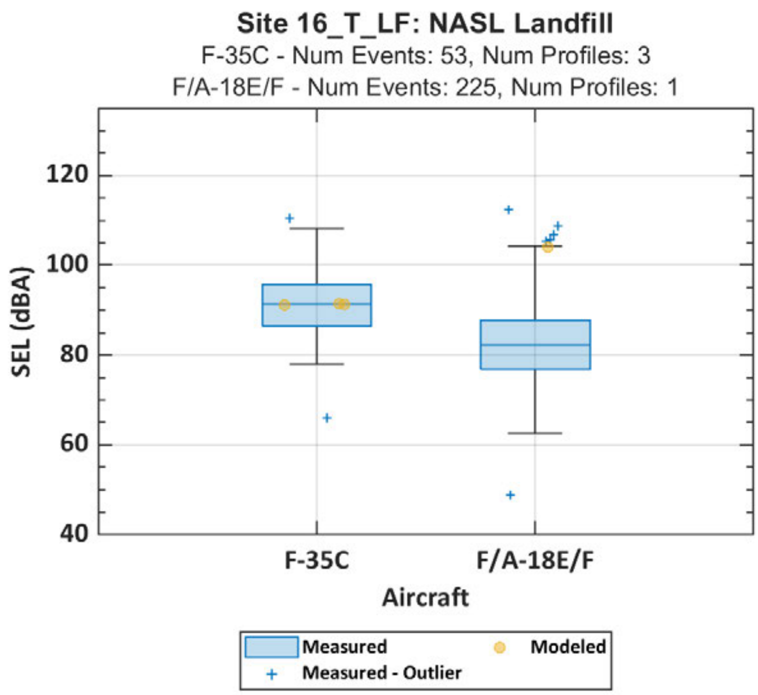


Figure D-16. NAS Lemoore Comparison Case 8

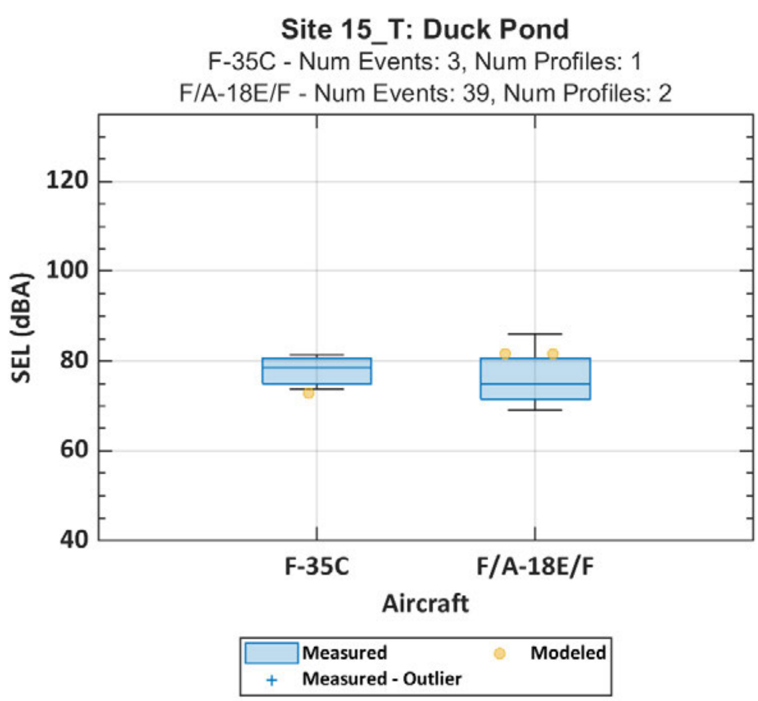


Figure D-17. NAS Lemoore Comparison Case 9

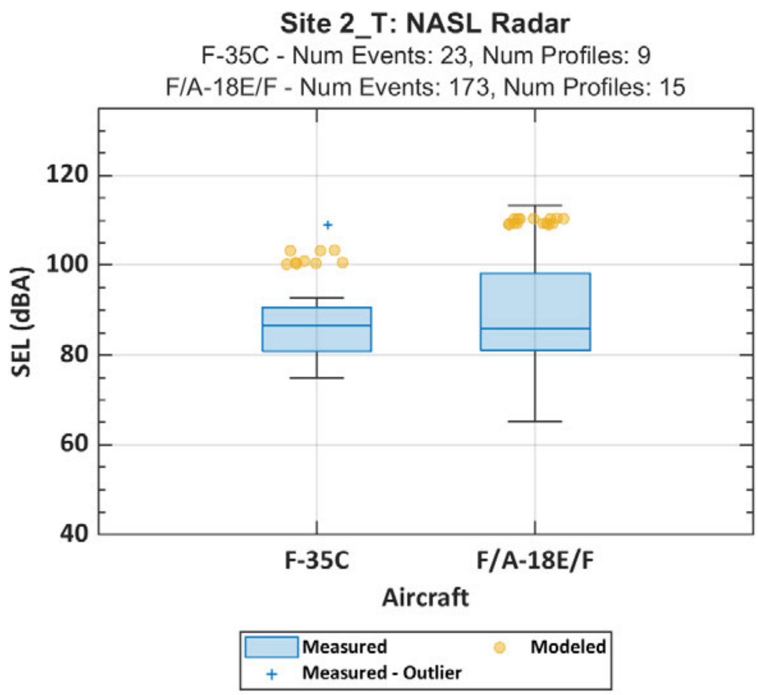


Figure D-18. NAS Lemoore Comparison Case 10

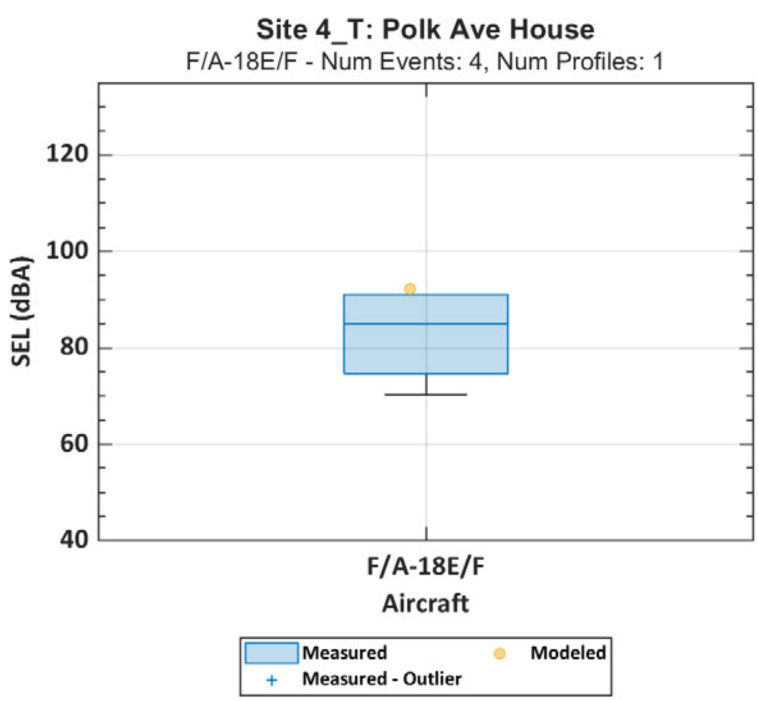


Figure D-19. NAS Lemoore Comparison Case 11

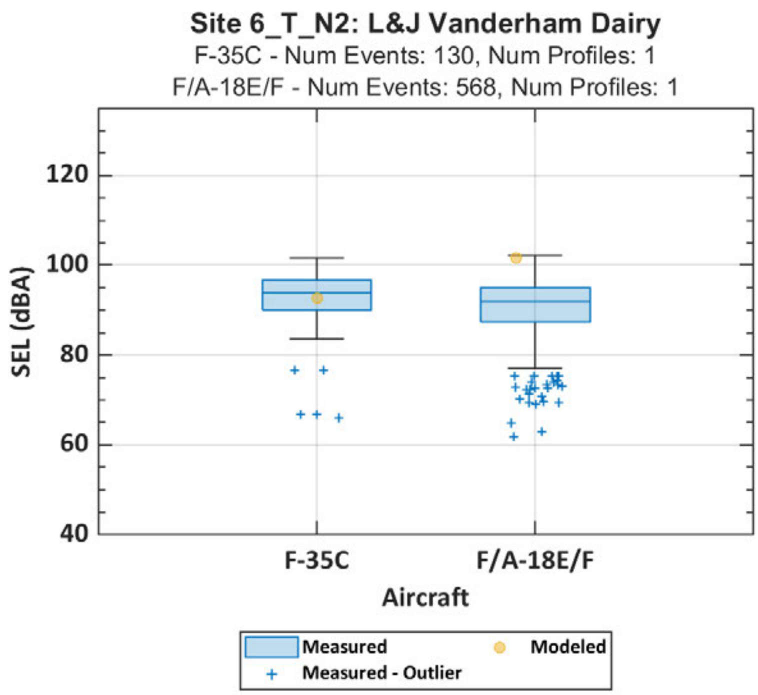


Figure D-20. NAS Lemoore Comparison Case 12

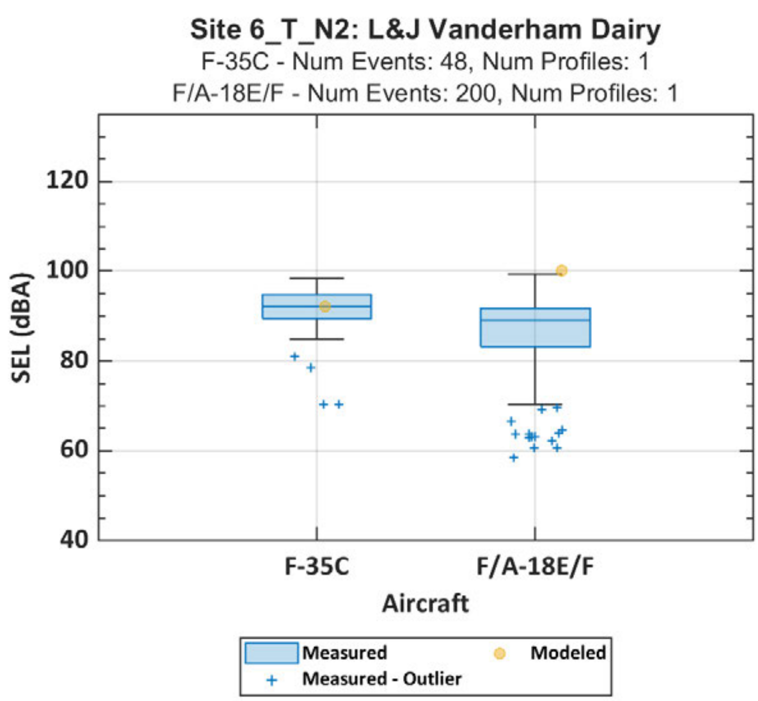


Figure D-21. NAS Lemoore Comparison Case 13

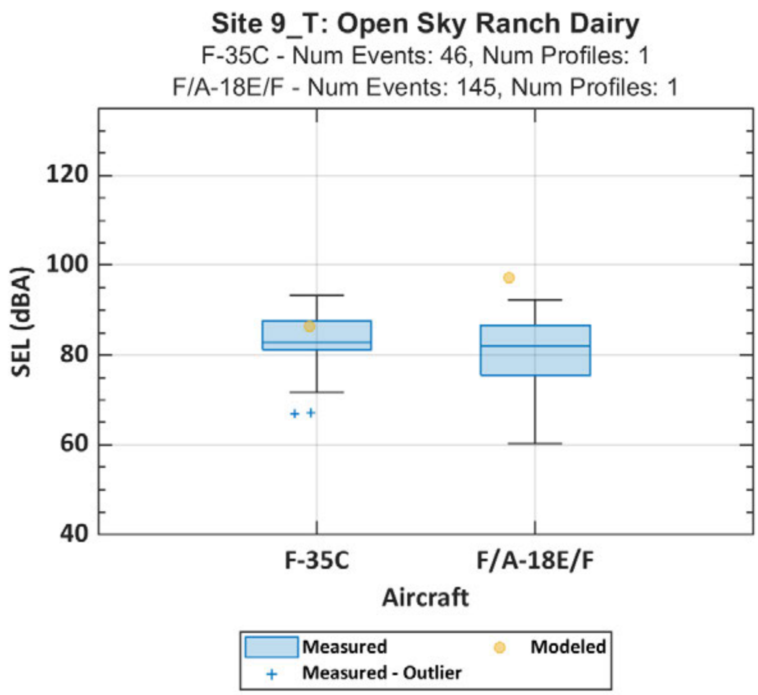


Figure D-22. NAS Lemoore Comparison Case 14

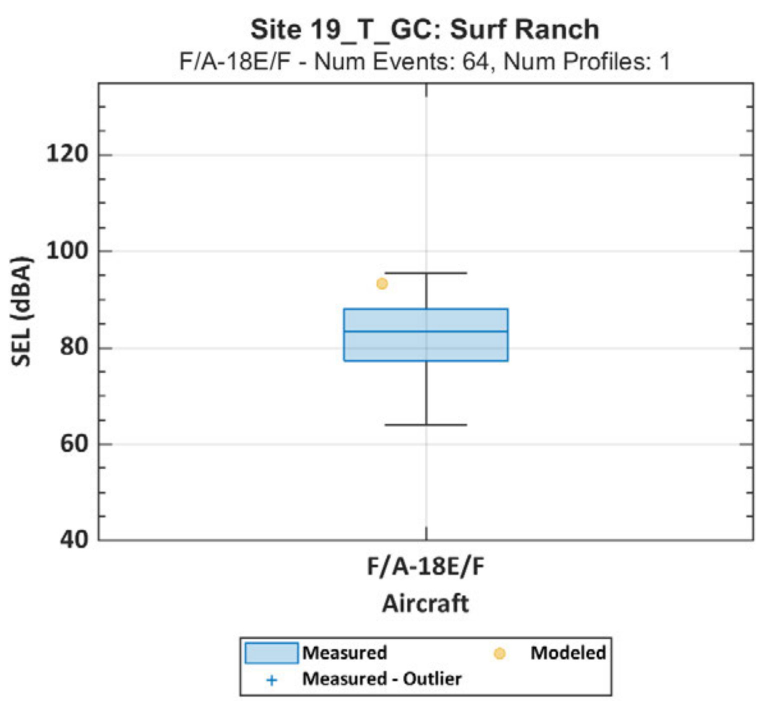


Figure D-23. NAS Lemoore Comparison Case 15

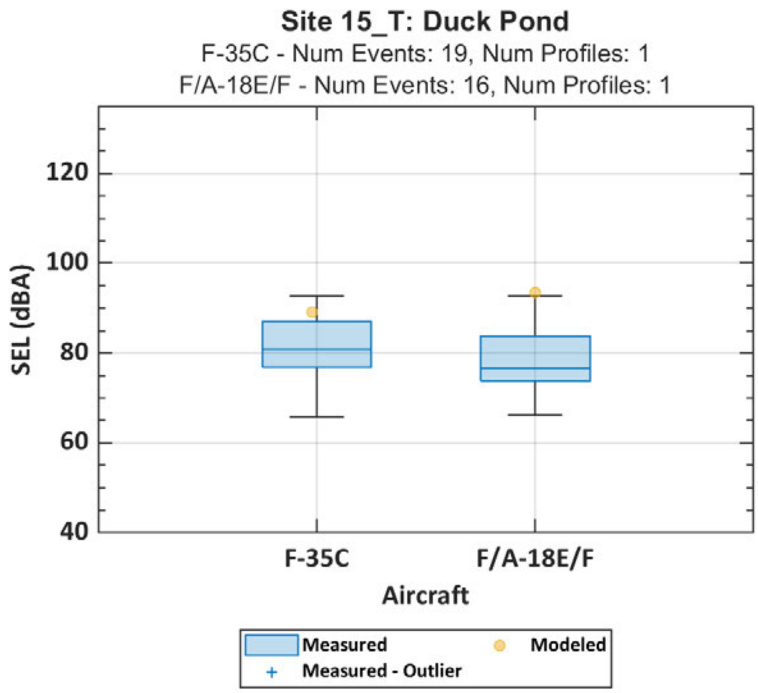


Figure D-24. NAS Lemoore Comparison Case 16

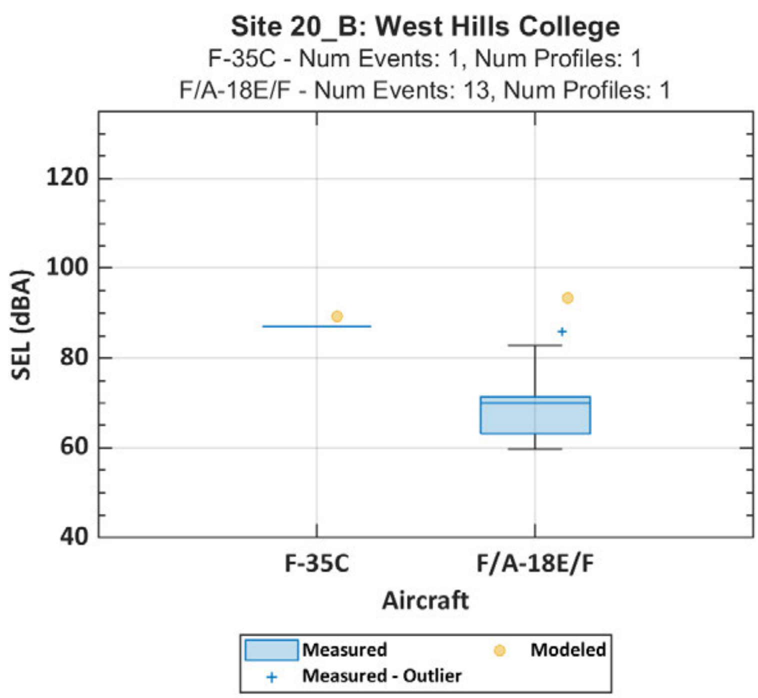


Figure D-25. NAS Lemoore Comparison Case 17

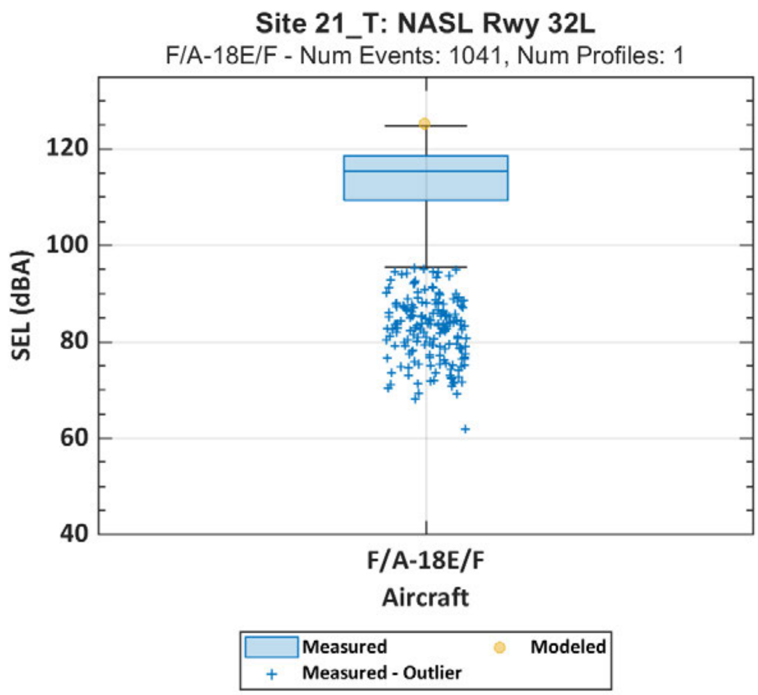


Figure D-26. NAS Lemoore Comparison Case 18

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES
	1 | 2

2. AMENDMENT/MODIFICATION NO	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ NO	5. PROJECT NO (If applicable)
P00001	12-Jul-2021	ACQR5782996	

6. ISSUED BY	CODE N62470	7. ADMINISTERED BY (If other than item 6)	CODE
COMNAVFACSYSCOM ATLANTIC 6506 HAMPTON BLVD NORFOLK VA 23508-1278		See Item 6	

8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)
CARDNO TEC-LE DOS, LLC
2496 OLD IVY RD STE 300
CHARLOTTESV LLE VA 22903-4895

CODE 6RMN5 | FACILITY CODE

	9A. AMENDMENT OF SOLICITATION NO.
	9B. DATED (SEE ITEM 11)
X	10A. MOD. OF CONTRACT/ORDER NO. N6247020F4047
X	10B. DATED (SEE ITEM 13) 13-Apr-2020

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in Item 14 The hour and date specified for receipt of Offer ☐ is extended, ☐ is not extended

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning ______ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS.
IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).
X	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF: FAR 52.243-1 CHANGES-FIXED PRICE (AUG 1987) - ALT III (APR 1984)
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor ☐ is not, ☒ is required to sign this document and return 1 copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)
Modification Control Number: SMOORE214300
N6247019D4009 NEPA, TAP, N6247020F4047 Noise Monitoring Study

This modification is issued to extend the contract completion date from 30 Sept 2021 to 31 January 2022. The time extension provides 4 additional months to make up for delays in on-site data collection due to COVID-19 travel restrictions.

Acceptance of this modification by the contractor constitutes an accord and satisfaction and represents payments in full for both time and money and for any and all costs, impact effect and for delays and disruptions arising out of, or incidental to, the work as herein revised.

All other terms and conditions remain the same.

CS [redacted] @navy.mil

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)	
[redacted], Dir. of Contracts		[redacted] Contracting Officer TEL: [redacted] EMAIL: [redacted] @navy.mil	
15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA	16C. DATE SIGNED
[redacted] (Signature of person authorized to sign)	7/15/21	BY [redacted] 146132055 Digitally signed by [redacted] (Signature of Contracting Officer)	

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1 CONTRACT ID CODE	PAGE OF PAGES
	1 | 2

2 AMENDMENT/MODIFICATION NO	3 EFFECTIVE DATE	4 REQUISITION/PURCHASE REQ NO	5 PROJECT NO (If applicable)
P00001	12-Jul-2021	ACQR5782996	

6 ISSUED BY CODE N62470	7 ADMINISTERED BY (If other than item 6) CODE
COMNAVFACSYSCOM ATLANTIC 6506 HAMPTON BLVD NORFOLK VA 23508-1278	**See Item 6**

8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)		
CARDNO TEC-LE DOS, LLC 2496 OLD IVY RD STE 300 CHARLOTTESV LLE VA 22903-4895		9A. AMENDMENT OF SOLICITATION NO.
		9B. DATED (SEE ITEM 11)
	X	10A. MOD. OF CONTRACT/ORDER NO. N6247020F4047
CODE 6RMN5 FACILITY CODE	X	10B. DATED (SEE ITEM 13) 13-Apr-2020

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in Item 14 The hour and date specified for receipt of Offer ☐ is extended, ☐ is not extended

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods:
(a) By completing Items 8 and 15, and returning ______ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS.
IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).
X	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF: FAR 52.243-1 CHANGES-FIXED PRICE (AUG 1987) - ALT III (APR 1984)
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor ☐ is not, ☒ is required to sign this document and return 1 copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)
Modification Control Number: SMOORE214300
N6247019D4009 NEPA, TAP, N6247020F4047 Noise Monitoring Study

This modification is issued to extend the contract completion date from 30 Sept 2021 to 31 January 2022. The time extension provides 4 additional months to make up for delays in on-site data collection due to COVID-19 travel restrictions.

Acceptance of this modification by the contractor constitutes an accord and satisfaction and represents payments in full for both time and money and for any and all costs, impact effect and for delays and disruptions arising out of, or incidental to, the w ork as herein revised.

All other terms and conditions remain the same.

CS [redacted], [redacted]@navy.mil

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) [redacted] CONTRACT SPECIALIST TEL: [redacted] EMAIL: [redacted]@navy.mil	
15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY [redacted] (Signature of Contracting Officer)	16C. DATE SIGNED 16-Jul-2021

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

SUMMARY OF CHANGES

SECTION 00010 - SOLICITATION CONTRACT FORM

DELIVERIES AND PERFORMANCE

The following Delivery Schedule Item has been deleted from CLIN 0001:

DELIVERY DATE	QUANTITY	SHIP TO ADDRESS	DODAAC / CAGE
POP 13-APR-2020 TO 30-SEP-2021	N/A	COMMANDER NAVFAC ATLANTIC [redacted] 6506 HAMPTON BLVD NORFOLK VA 23508-1278 [redacted] FOB: Destination	N62470

The following Delivery Schedule item has been added to CLIN 0001:

DELIVERY DATE	QUANTITY	SHIP TO ADDRESS	DODAAC / CAGE
31-JAN-2022	1	COMNAVFACSYSCOM ATLANTIC [redacted] 6506 HAMPTON BLVD NORFOLK VA 23508-1278 [redacted] FOB: Destination	N62470

(End of Summary of Changes)

N4425521RP00016

RIGHT OF ENTRY AGREEMENT

In consideration of the assistance and benefits as described herein, Whidbey Camano Land Trust (herein after referred to as the "OWNER"), located at 765 Wonn Rd Barn Suite C-201, Greenbank, WA 98253, hereby grants to the UNITED STATES OF AMERICA, DEPARTMENT OF THE NAVY, its employees, agents, contractors and subcontractors (collectively known as the "GOVERNMENT"), a right of entry upon the premises described below, located in the State of Washington, with the following terms and conditions, effective beginning on November 13, 2020 and ending on December 31, 2021, unless sooner terminated under the terms and conditions herein set forth.

Premises: Island County Parcel R13113-060-1980; and as depicted in the attached Exhibit "A".

Purpose: The OWNER grants to the GOVERNMENT a right to enter the premises to place a sound level meter on the property for four (4) non-contiguous weeks during the term of this Right of Entry Permit. The equipment is temporary in nature and consists of a standard tripod with a microphone attached at approximately 5 feet high and connected to a small battery pack with a solar panel.

Notification: Government will provide at a minimum 24-hour's notice prior to access by contacting the Point of Contact identified below.

Ownership of Tools and Equipment: All tools, equipment, and other property taken upon or placed upon the Premises by the GOVERNMENT shall remain the property of the GOVERNMENT and will be removed by the GOVERNMENT at the end of each of the four (4) non-contiguous weeks of this right of entry.

No Warranty: OWNER grants this right of entry without warranty, either express or implied, regarding to the suitability of the condition of the Premises. The GOVERNMENT shall not hold OWNER liable for any shortage or defect in any part of the Premises or on account of theft of, or damage to, the GOVERNMENT's tools, equipment or other property taken or placed upon the Premises or any physical injury, death or disability of GOVERNMENT employees, trainees, or other personnel associated with the purpose of this Agreement, except where such loss, damage, injury, death, or disability is caused by the fault or negligence of the OWNER.

Liability Limits: The GOVERNMENT agrees to be responsible for damages arising from the activity of the Navy, its officers, employees, authorized representatives (including contractors) on the OWNER's land, under this right of entry, to the extent

authorized by law, including the Federal Tort Claims Act (28 U.S.C. § 2671 et seq.).

The OWNER shall not be responsible for damages to the property or injuries to persons which may arise from or be incident to the GOVERNMENT's use and occupation of such premises pursuant to this right of entry, nor for the damages to the property of or injuries to the GOVERNMENT, or others who may be on the premises at the GOVERNMENT's invitation, except where such damages or injuries are due to the fault or negligence of the OWNER.

The GOVERNMENT shall not be responsible for damages to property or injuries to persons which may arise from or be incident to the use and occupation of the premises by the OWNER, its agents, servants, or employees, or others who may be on the premises at the OWNER's invitation, except where such damages or injuries are due to the fault or negligence of the GOVERNMENT.

Termination: OWNER may terminate this right of entry in the event the GOVERNMENT fails to comply with the terms and conditions of this agreement or in the event of a change of ownership or use of the Premises that OWNER deems inconsistent with continued GOVERNMENT use of the premises. Prior to terminating this right of entry, OWNER shall give the GOVERNMENT no less than thirty (30) days' notice. GOVERNMENT shall have (30) days from receipt of said notice to remedy any failure to comply with the terms and conditions of this right of entry.

Compliance with Laws: All activities performed by the GOVERNMENT on the Premises will be performed in a lawful and prudent manner and in compliance with applicable laws, rules, and regulations, and will not unreasonably interfere with OWNER's normal activities.

No Assignment: The GOVERNMENT may not assign this right of entry or the rights and obligations set forth herein, in whole or in part.

Points of Contact:

OWNER: (b) (6) [redacted] Stewardship Director
(b) (6) [redacted]@wclt.org
(b) (6) [redacted]

GOVERNMENT: [redacted]
Realty Specialist
NAVFAC NW
[redacted]@navy.mil

Consideration: OWNER acknowledges as good and valuable consideration the benefits to be derived from this Right of Entry.

Authority: The signatories below represent that they are authorized to execute this Agreement on behalf of the parties.

Entire Agreement: This instrument contains the entire agreement between the parties and supersedes any prior understanding, whether written or verbal.

In Witness hereof, the parties hereto have mutually agreed upon the terms and conditions of this instrument and caused it to be executed as below subscribed:

OWNER

By: [redacted]
[redacted]
Executive Director, Whidbey Camano Land Trust

Date: 11/10/2020

UNITED STATES OF AMERICA

By: [redacted]
Real Estate Contracting Officer

Date: 11|17|2020

N4425521RP00016

Exhibit "A"

Parcel R13113-060-1980
Legal Description: a portion of Section 13, Township 31 North, Range 1 East, W.M.
Island County, State of Washington